POPULAR Computing WEEKLY

35p 16-22 June 1983 Vol 2 No 24

This Week

Graphics software
Graham Taylor weaves his way through a tapestry of graphics programs including *Psst*, *Mutant Herd* and *Artist's Designer*. See page 14

I robot
David Kelly talks to John Reekie of Colne Robotics about the upsurge of interest in personal robots. See page 13

Spectrum moon
Maurice Gavin presents a program to show all the phases of the moon's orbit around the earth on page 20

New releases
All the latest games for the popular micros including *Joust* from Softek and *Confuse the Cat* from EF Computing. See page 45

★ STAR
Connect 4 on BBC.
See page 10.
GAME ★

News Desk

Busy time for the Commodore

THIS year's International Commodore Computer Show held last weekend at the Cunard Hotel in London really belonged to the Commodore 64 machine.

Two new machines were shown based on it — the range of SX64 portable computers with built-in black-and-white or colour monitors and twin disc drives priced between £650 and £995, and a 64K colour machine in an old style Pet housing, for the education market.

A range of low-cost printers were unveiled for the Commodore 64 — the 1520 four-colour printer plotter at £169.99, the 1525 tractor feed dot matrix printer at £230 and the 1526 bi-directional letter quality printer at £345.

Also announced for the 64 was a 14-inch colour monitor which will sell for £230 and a speech synthesiser unit for under £50, available in September.

Continued on page 5

Arise, Sir Micro-chip!

CLIVE Marles Sinclair has been awarded a knighthood in the Queen's Birthday Honours List.

He said of the news: "It was completely unexpected and a wonderful surprise — more than ever I find myself committed to achieving success here in, and for, Britain."

At 42 he is the founder of a company which has become the world's largest volume manufacturer of personal computers and is largely responsible — with the ZX80, ZX81 and most recently the Spectrum — for making the microcomputer a household item in the UK.

After leaving school at 17 he worked for four years as a technical journalist before founding Sinclair Radionics in 1962. This company produced the Executive pocket calculator at the then revolutionary price of £79. In the late 1970s he joined forces with the

Continued on page 5



Classified

Continued on page 4

★ ★ CHICAGO FAIR EXCLUSIVE — PAGE 4 ★ ★

POPULAR Computing WEEKLY

16-22 June 1983 Vol 2 No 24

SUNSHINE

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Telephone **01-839 6835**
Published by Sunshine Publications Ltd
Typesetting, origination and printing by
Chesham Press Chesham Bucks
Distributed by S M Distribution
London SW9 01-274 8611 Telex 261643

Subscriptions
You can have *Popular Computing Weekly* sent to your home

UK Addresses

26 issues	£9.98
52 issues	£19 95

Overseas Addresses

26 issues	£18 70
52 issues	£37 40

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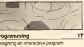
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Popular Computing Weekly cannot accept any responsibility for any errors in programs we publish although we will always try our best to make sure programs work.

This Week



Editorial

Arise Sir Microchip! Clive Sinclair, the driving force behind the world's most prolific microcomputer company, has been awarded a knighthood

This honour reflects Sinclair s position as the man who more than anyone else, has transformed Britain from a nation of shopkeepers to a nation of micro users Three years ago few people outside the electronics industry were familiar with either Sinclair or micros Now, the two are almost synonymous

Yet, for a man who has single-mindedly devoted himself to building up his own business, Sinclair's interests are very wide-ranging He is an athlete and he has completed a number of marathons including the New York

His other pursuits tend not surprisingly for a chairman of Mensa, to be of a more intellectual nature He is a keen reader of poetry and has been known to attend the opera He also takes a more than passing interest in the world of publishing, both through his sponsorship of the Sinclair Prize for Fiction and his partnership in the Sinclair Browne publishing firm

Clive Sinclair has done more than most to deserve a knighthood and few will begrudge him the award However, I suspect that to the thousands of Sinclair owners, both here and overseas, Sir Clive will always remain Uncle Clive

Next Thursday

Funfair for the 16K Spectrum is an original arcade type game where you as a clown s face have to catch bubbles in your mouth from the bubble blower across the stream! Funfair — next week s Star Game by Jack Knight

Commodore announced another dramatic price drop for the Commodore 64 machine and surprised many by deciding to discontinue sales to dealers of the Vic20 in August The company clearly wishes to drop the Vic in favour of the 64 and, to that end the 64 now sells for only $199, with a special offer of a further $100 off the price in part exchange for a used Vic

Prices of Rom software were also slashed — coming down to only $9 95

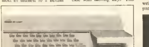
Mattel showed a new computer, the Aquarius II With 20K Ram expandable up to 64K, full travel keyboard, Extended Basic, 16 colours and a high resolution graphics mode of 320 x 192 resolution the machine should be available in the US this winter



Other Mattel products on show for the first time were a 40/80 column, four colour, printer and the Master Expansion Module with CP/M compatible disc drives for the Aquarius and Aquarius II

Texas Instruments confirmed the demise of its new 99/2 mute black-and-white computer Instead the company has repackaged the 99/4A and cut its cost drastically to around $130

Timex provided perhaps the most of interest to a British visitor, presenting three new computers based on Sinclair technology — the TS2048/TS2068 and the TS1500



Both the TS2048 and the TS2068 are drastically altered Spectrums The TS2048 has 24K Ram and 16K Rom selling for $149 95 and the TS2068 has 48K Ram and 24K Rom Looking completely different from their UK equivalent in a silver livery the TS2000s have a number of additional features

The keys have a more positive feel and a space-bar has been added Both models feature a built-in Rom cartridge slot and joystick port Extra commands include *On-Error*, *Stick*, *Free* (to determine the memory remaining) and *Sound* giving access to a three-channel synthesiser The TS2068 also features a second 64 character width 256 x 192 high-resolution display mode

The TS1500 is a ZX81 equivalent with 16K built-in packaged in a Spectrum like case with moving keys This will sell for $80 An interface, which can be connected to the back of the TS1500 enables it to run Rom cartridge software

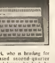
Finally, Timex are now selling the 2K ZX81 equivalent the TS1000 for $29 95, about £19

Tim Hartnell reports from the CES Consumer Electronics Show



THE CES Consumer Electronics Show held at the McCormick Center in Chicago last week is one of the key trade shows in the US

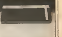
By British standards its size is awesome The attendance over the four day show topped 80,000 – and that is only members of the trade the public were not allowed to visit The actual display area was more than five times the size of our own Personal Computer World show – buses were laid on just to ferry visitors around the exhibition area



Atari, who is heading for increased second-quarter financial losses, hit back by launching an almost entirely new product range Of particular interest were four new computers two of which are aimed firmly at the home computer market

The 600XL is 6502 based with 24K Rom 16K Ram (expandable to 64K) and a full-size keyboard It has 256 colours four voices and a 40 x 24 character display There are five text display modes and 11 graphics display modes with a maximum resolution of 320 x 192 The 600XL is seen as a compentor for the Vic20 and TI99/4A and will sell for $199

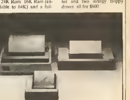
The 800XL machine is the same as the 600XL but with a built in memory of 64K The other two machines are the 1400XL with 64K built-in modem and four programmable function keys and the 1450XL with 64K Ram, function keys built-in modem,



speech synthesiser and dual-density double-sided disc drives

Among the other products on show from Atari were a new 1010 cassette unit ($99 95), a four colour printer/plotter, the 1020 ($299 95), an 80-column dot-matrix printer, the 1025 ($549), and a letter-quality printer the 1027 ($349 95) A modem, the 1030 was shown, as was a new 1050 disc drive ($450), touch tablet controller trak ball controller new joysticks and a CP/M module

CBS announced what became the star attraction of the show — the Colecovision Adam computer The Adam comes with separate keyboard and processor unit a pair of joysticks, a daisy wheel printer and two stringy floppy drives all for $600



Busy time for the Commodore

Continued from page 1

Software for the 64 is now coming through in a flood, both from Commodore itself and from the independent suppliers

The most outstanding games program was *Soccer*, previewed by Commodore for release on Rom later in the summer Commodore showed ten new titles that are available immediately *Radar Rat Race*, *Sea Wolf* *Clowns* *Jupiter Lander* and *Music Composer* on cartridge and *Sooper*

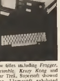


Froot, *Stellar Wars* *Depth Charge* *Labyrinth* and *Super Blitz* on cassette

Education material was also strong from Commodore Two impressive series of animated graphics programs with words and speech using the speech synthesiser unit were shown Called *The Magic Garden* and *The Magic Workshop*, both should be available for around £15 on cartridge at the same time as the synthesiser in September

Other languages being demonstrated for the 64 included Logo on disc for around £25 and Comal on disc or cartridge — both scheduled for the autumn

The independent houses tended to concentrate on games software for the 64 Interceptor Micros showed six



new titles including *Frogger*, *Scramble* *Krazy Kong* and *Star Trek*, Supersoft showed *Stix*, Llamasoft exhibited *Attack of the Mutant Camels* Bubble Bus showed *Hustler* and Rabbit displayed a range of titles including *Anhilator* and *Centropods*

Atari takes on founder

ATARI has resolved the dispute with its founder Nolan Bushnell, by re-employing him

The company had been taking legal action against its founder who sold the company to Warner Communications for $15m in 1976 to stop him from competing with them (see *Popular Computing Weekly*, April 21)

Now, under an agreement between Atari and Bushnell's new arcade game company, Sente Technologies, Atari gains the video game and home computer rights to the new coin-operated games — games developed by Sente

Raymond Kaffer, Atari's chairman commented "We are pleased to have Nolan Bushnell back with us — he is an acknowledged innovator in the video game business "

The agreement forms part of a campaign by Atari to regain a major share of the video games market Warner's Consumer Electronics Division, which includes Atari, announced dismal 1982 financial results, with income less than 1 percent of the previous year's total

● Sente Technologies is only one of several ventures started by Bushnell since leaving Atari His most recent venture has been Androbot Inc, a bid to get in first into what promises to be the next big boom industry — personal robots

Sir Micro-chip

Continued from page 1

National Enterprise Board to produce the first pocket tv, the Microvision And in 1979 he established his present company, Sinclair Research

In January this year a share placement valued the company at £135 9m, with Sinclair's personal holding being worth £129 1m

Clive is now concentrating on the new flat-screen tv project, other research investigations — an electric car and a personal robot — and a joint publishing venture Sinclair Browne

He is the current chairman of Mensa and his interests include running poetry and opera

Computer fair

THE Earl's Court Computer Fair which begins this Thursday, June 16, should offer much of interest

It seems likely that Sinclair Research will demonstrate — although probably not sell — its overdue Microdrive storage system for the Spectrum, together with the RS232 and networking interface

Memotech will show its new microcomputer for the first time It is a low-cost machine in the under-£300 price range

Mattel will show its Aquarius micro and Camputers will exhibit a 96K version of its Lynx

Dragon Data will launch its 5¼ inch disc drive system at the show, running a Dragon Data operating system

It is also just possible that Acorn could launch its long awaited 'Tube' interface and second processors for the BBC machine

Lynx links up

A SELECTION of interfaces will soon be available from Camputers for the Lynx

The Lynx joystick interface pack will enable up to two Atari-compatible joysticks to be connected The interface plugs into the expansion port at the rear of the computer and also includes its own follow-on expansion port so it is still possible to connect discs or a parallel printer The joystick interface is £14 95

To connect a serial RS232 printer a lead costing £3 99 is required The 96K Lynx contains the necessary software to interface the RS232 printer but the 48K machine does not Consequently the software will be supplied on a free cassette included with the lead to 48K owners

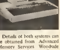
To connect a parallel printer a Centronics interface is needed This will be available from August priced at £49 95

Expansion options for BBC

TWO companies have come up with altogether different expansion options for the BBC micro

Advanced Memory Systems has produced a disc pack using the new Hitachi 3-inch drives The double-sided discs have a storage capacity of 100K per side and the system costs £225 or £399, for either a single or double drive arrangement

Contol Universal has produced Beeb-Ex, a low cost interface card which plugs into the 1MHz bus In its simplest configuration, up to four application cards can be connected allowing up to 1M of additional data storage memory to be addressed in page mode or either an 8- or 12-channel analog interface to be connected The rack mounted system is also compatible with Acorn Eurocards A four-card interface costs £49 a/d convertors are from £120 64K DRam cards are from £148 and a *Star I/O* Eprom gives the interface access to Basic filing commands



Details of both systems can be obtained from Advanced Memory Services Woodside Technology Centre Green Lane Appleton Warrington, and Control Universal Unit 2, Anderson's Court, Newnham Road, Cambridge

Dragon launch delayed

THE UK launch date of the 64K Dragon 64 machine has been put back

The expanded machine, together with the OS9 disc operating system will not now be available until September

Dragon's own disc operating system and 5¼ inch disc drives should go on sale in July

Accidental error

Whilst trying to draw a semi-circle in a program that I was writing I accidently mis-typed the *Draw* statement. To my utter amazement the Spectrum started to draw some triangles, rotating them until a solid block of colour was produced.

The following six programs draw a variety of different shapes.

```
Graphics
 10 PLOT 100,100
 20 DRAW 50,50 PI*88

 10 PLOT 100,100
 20 DRAW 50 50 88*PI

 10 PLOT 100,100
 20 DRAW 50 50,800*PI

 10 PLOT 100,100
 20 DRAW 50 50 88*PI

 10 PLOT 100,100
 20 DRAW 50,50 PI*8

 10 PLOT 100,100
 20 DRAW 50 50 PI*10
These programs all use the
DRAW command to draw
straight lines   which when
run draw interesting
patterns on the screen.
```

David Goodman
46 Melwood House
Watney Market
London E1 2QX

Out of reach

Could you please explain the position as regards the continuing debate on copy right with reference to the forthcoming teletext receiver for the BBC computer.

As the cost of this receiver has now risen to over £200 I feel that it is out of the reach of most private users. However, I am quite prepared to contribute my share with four friends to get a teletext receiver between us.

Unfortunately, the copy right notice in Rem (the telesoftware newsletter on Ceefax 700) only permits two copies of any program to be made. While not wishing to infringe on copyright this legally prohibits my friends and I from using the service as we would wish.

I would welcome your comments/advice on this situation.

S Parker
23 Thorneycroft St
Birkenhead
Merseyside

This is a moot point. Personally, I can see no good reason why the five of you should not benefit from clubbing together to buy a teletext receiver. However, the law is extremely murky where computer copyright is concerned.

Your best course of action is probably to write to the BBC, explain the situation, and ask for permission to make five copies of each program (for your personal use only).

Please let us know the results of your enquiries.

Pac-Man champion?

I recently scored 3 256,400 points on the Commodore cartridge *Jelly Monsters*. It took me over five hours. Am I the world *Pac Man* champion, or is there someone out there who can better this score?

Terence Wilkins
21 Cherrton Field
Fulwood
Preston
Lancashire PR2 3WH

Not representative

Has anyone else noticed? It's changed! The Top 10 chart for the Spectrum that is. It was with great regret that I saw that you have followed the example set by the other computer magazines and used the chart compiled by W H Smith & Son Ltd. Since Smiths only stock a narrow and very limited range of Spectrum programs, their figures can patently not be representative of the number of programs sold for the Spectrum over the country as a whole.

Obviously it is difficult to obtain a really accurate assessment of which programs are selling best in any one week but using a chart produced by a chain store is not the best way. It is interesting to note that the last figures shown produced by the Buffer Micro shop in London (19-25 May) bear practically no relationship to those shown the following week produced by W H Smith. A close examination will reveal that only two of the programs in the Buffer Micro Top 10 are currently even stocked by Smiths.

Due to the charts influence the effect of using figures produced by Smiths is to give them overwhelming power in relation to buying programs from any software company. In short, it enables them to demand a quite monstrous proportion of the selling price of any program. I wonder how many of your readers know that this is typically 60 percent or more (one of the real reasons for the high price of computer software). In addition, Smiths also provide very limited facilities to view a program in action before its purchase.

Such a situation is extremely damaging and unhealthy to the industry as a whole. It provides no opportunity to the smaller software houses that often produce the best programs. A magazine such as yours should be bringing these to people's attention.

Perhaps the best way of compiling a fair and representative chart is to follow the example set by the music charts. Select a number of specialist computer stores that stock a large range of software for the Spectrum and collate the figures from these yourselves. It would be desirable to keep the actual shops chosen a secret and to only use figures from some of them every week. Such a system would itself be open to some criticism. For instance, it would take no account of the large volume of sales made through mail order. Nevertheless it would be infinitely preferable to the present system.

So to summarise please change and improve the way the Top 10 Spectrum chart is compiled (and the charts for the other computers as well, for that matter). Let's see *PCW* be the magazine to lead the way and make the changes.

David Hughes
40 Beechwood Mount
Burley
Leeds LS4 2NQ

Unfortunately, the point you make about the Smiths chart being unrepresentative also applies to the Buffer Micro chart, as it does to any chart compiled from a single source. We are actively looking at ways of making the charts more representative and will keep you informed of our progress.

Off the market

I have been buying your excellent magazine for almost a year and read with interest the recent headlines about the new Buy 'n Try service. I think that the software companies have a valid point about it encouraging tape copying, and yet in the classified pages of the same magazine there were several advertisements for programs such as 'The Key'. In the words of the manufacturer Keysoft "First of all you have to back-up programs by making tape-to-tape copies. Now Keysoft present 'The Key'."

Quite obviously 99 percent of programs sold of this kind will be bought solely to make copies of software, thus breaking the copyright acts. The only warning given to purchasers in this particular case was that "Keysoft advise people not to infringe the copyright acts." What else are they going to do with it?

I believe that these programs pose just as much of a threat as the Buy 'n Try scheme and I personally think that steps should be taken to attempt to take them off the market.

PS Thanks for *Foxbat* and *Space Panic*, both of which were excellent.

Andrew Ratter
39 Cramond Terrace
Edinburgh EH4 6PW

This is clearly an issue which needs to be aired. Once again, the law fails to provide any clear guidelines.

We would be interested to know what our readers think of the issue and also the views of the software industry.

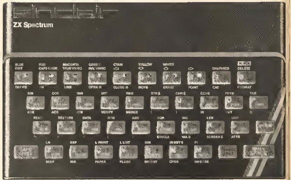
Hour of need

Please allow me to appeal to the readers of *Popular Computing Weekly* for help in my hour of need. I badly need a program (Vic20) for selecting *r* items from *n*. I have needed such a program for a long time, but have been unable to write one (puzzle number 53 uses one (or could use one).

Might it not be possible to set up a column in your paper where the likes of me can ask for help?

J F Mensink
98 Acomb Crescent
Newcastle-upon-Tyne
NE3 2RD

Sinclair ZX Spect



The growing range of Spectrum Software



You'll know elready thet the Spectrum has generated an enormous range of peripherals and independent software Our own range is growing very fast and is shown in the Sinclair Software Catelogue – *free* with every ZX Spectrum.

Connect 4

A new game for the BBC by M Kendrick

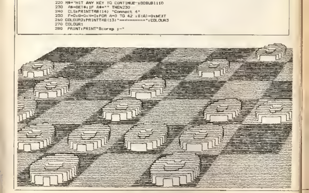
This program is a computerised version of the game Connect 4. It is written on a model B BBC micro, but can be used on a model A by modifying the mode/colour commands. The object of the game is to form a line of 4 counters horizontally, vertically or diagonally. The board fills from the bottom upwards.

The controls are as follows

4 — moves curser left
6 — moves curser right
Space bar — places counter in column under cursor

Using this program on a colour tv produces an unusual effect with one of the user-defined characters ■

```
>LIST
   10  REM ************************
   20  REM **    Connect 4       **
   30  REM **    M.Kendrick      **
   40  REM **      1983          **
   50  REM ************************
   60  MODE1
   70  B1%=0:B2%=0:B5%=0
   80  MM=0:D=0:VDU23;8202;0;0;0;
   90  FLAG =0
  100  VDU 23,255,255,255,255,255,255,255,255,255:VDU23,254,170,85,170,85,170,85
,170,85:VDU19,2,2,0,0,0,19,3,3,0,0,0
  110  CLS:PRINT "        Connect 4  "
  120 PRINT"         ==========="
  130 PRINT:COLOUR1:PRINT" 1.The object is to get a line of 4 "
  140 PRINT:COLOUR2:PRINT" 2.The board is a 6 by 7grid .A line may be horizontal
,vertical or diagonal ."
  150 PRINT:COLOUR1:PRINT" 3. Columns are filled from the base upward."
  160 PRINT:COLOUR2:PRINT" 4. The following keys are used :-"
  170 COLOUR1:PRINT"      6 ";:COLOUR3:PRINT"Move right."
  180 COLOUR1:PRINT"      4 ";:COLOUR3:PRINT"Move left."
  190 PRINT:COLOUR3:PRINT" The space bar drops your counter to the foot of the c
olumn"
  200  DIM S(44),T(11),N(7)
  210   FOR LOOP=1TO 4000:NEXT
  220 M$="HIT ANY KEY TO CONTINUE":GOSUB1110
  230  A$=GET$:IF A$="" THEN230
  240  CLS:PRINTTAB(14) "Connect 4"
  250  F=0:G=0:H=0:FOR A=0 TO 42 :S(A)=0:NEXT
  260 COLOUR2:PRINTTAB(13)"==========":COLOUR3
  270 COLOUR1
  280  PRINT:PRINT"Scores :-"
```



```
290  PRINT"            |   |   |   |   |   |   |   |"
300  FOR T=1 TO 5
310    PRINT"          |   |   |   |   |   |   |   |"
320   PRINT'           |   |   |   |   |   |   |   |"
330   PRINT"           +   +   +   +   +   +   +   +"
340    NEXT
350 PRINT"             |   |   |   |   |   |   |   |"
360 PRINT              |   |   |   |   |   |   |   |"
370 PRINT"             =============================="
380  COLOUR2
390  PRINTCHR$(30);TAB(1,7)"YOU   ";S1%;PRINTTAB(1,9)"ME   ";S2%;PRINTTAB(1,11)
"DRAWN ";S3%
400  WHITE$=CHR$255+CHR$255+CHR$255;BLACK$=CHR$254+CHR$254+CHR$254:CUR$="<"+CH
R$254+CHR$254+">"
410  N%=36;FOR C=1TO7;N(C)=N%;N%=N%+1;NEXT
420  C=4
430 COLOUR3
440   S=S1%+S2%+S3%;IF S/2 <>INT(S/2) THEN710
450  M$='  My Move   ":GOSUB 1090
460  V=0;X=0;Y=0;Z=0
470   FOR LOOP=1 TO 7;C=C+1:IF C>7 THENC=1
480   X1=7+4*C;IF N(C)>0 THEN GOSUB 840
490   IF F THEN 670
500   NEXT
510  IF X THEN C=X:GOTO670
520 IF Y THEN C=Y:GOTO540
530 IF Z THEN C=Z:GOTO560
540  C=RND(7);IF N(C)<1 THEN540
550 V=V+1;IF C<>4 AND V<5 THEN540
560 IF N(C)<8 THEN F=0:GOTO 670
570 IF V<10 THEN630
580 IF V/3 = INT(V/3) THEN MM=1 ; M$="Now what do i do??":GOSUB 1110
590 IF V<21 TNEN630
600  FOR LOOP= 1 TO 500:D=RND(1000)+&7C00
610   J=RND(256);?D=J
620   NEXT:GOTO820
630 N(C)=N(C)-7;Z=0:GOSUB840;N(C)=N(C)+7
640 IF F TNENF=0 :IF V<9 THEN 540
650 IF Z THENZ=0 :IF V<6 THEN 540
660 IF X THENX=0 :GOTO540
670 X1=7+4*C;X2=5+3*(N(C)-C)/7
680 PRINT CHR$30TAB(X1,X2)WHITE$;TAB(X1,X2+1)WHITE$
690 S(N(C))=5;N(C)=N(C)-7
700  IF F THEN M$='I WIN ''";MM=1;GOSUB 1110:S2%=S2%+1:GOTO210
710  M$="   Your Move   ":GOSUB1090
720 X1=7+4*C;PRINTCHR$30TAB(X1,3)CUR$
730 Z$=GET$:IF Z$="" THEN730
740 IF Z$="6" TNEN IF C<7 THEN C=C+1
750 IF Z$="4' THEN IF C>1THEN C=C-1
760 IF Z$=" ' TNEN780
770 PRINT CHR$30TAB(X1,3)"    ":GOTO720
780 L=(N(C)-C)/7:IF L<0 THEN720
790 X1=7+4*C;X2=5+3*L
800 PRINTCHR$30TAB(X1,X2)BLACK$;TAB(X1,X2+1)BLACK$
810 B(N(C))=1:E=0:GOSUB 840
820  IF E THEN M$=" YOU WIN ''":GOSUB 1090:S1%=S1%+1:GOTO 210
830 N(C)=N(C)-7:GOTO450
840 PRINTCHR$30TAB(X1,3)CUR$
850 A=0:REPEAT T(A)=0:A=A+1: UNTIL A+12
860 I=0:M=N(C)
870 FOR U=M TO M+21 STEP 7:IF U>42 THEN890
880   T(I)=T(I)+B(U)
890   NEXT:I=I+1
900 FOR A= C-3 TO C+3 ;IF A+1 THEN A=1
910   IF A>4 OR A>C THEN 950
920   FOR B=A TO A+3;T(I)=T(I)+B(M-C+B):NEXT:I=I+1
930   N%=M-(C-A)+8:IF N%<1 OR N%>18 THEN 950
940   FOR D=0 TO 3;T(I)=T(I)+S(N%);N%=N%+8:NEXT:I=I+1
950   IF A>7 THEN990
960   IF A<4 OR A<C THEN 990
970   N%=M+(C-A)*6:IF N%<4 OR N%>21 THEN990
980   FOR D=0 TO 3;T(I)=T(I)+B(N%);N%=N%+6:NEXT:I=I+1
990   NEXT
1000 FOR H=0 TO I ;D=T(H):IF D=4 THEN E=1
1010   IF D=15 TNENE=C
1020   IF D=10 THENZ=C
1030   IF D=3 THENX=C
1040   IF H AND D=2 THEN Y=C
1050   NEXT
1060 PRINT CHR$30 TAB(X1,3)"    "
1070 RETURN
1080 STOP
1090  FORA =1 TO 7:IF B(A)=0 TNEN FLAG=1
1100    NEXT:IF FLAG=1 THEN FLAG=0 ELSE M$="It's a Draw":G=1
1110 PRINTTAB(20-LEN(M$)/2,23)M$
1120  IF MM=0 THEN1140
1130  FOR D= 1TO 1000:NEXT:MM=0:M$="':GOTO1110
1140   IF G THENG=0:S3%=S3%+1:GOTO210
1150  RETURN
```

Arms and the man!

***David Kally** talks to John Reakie about a new high technology industry – robotics*

There is a growing feeling that the next big boom industry after microcomputers will be personal robots

Imagine a radio-controlled self-propelled robot about four feet tall It can find its way about, remember what it has learnt and where it has been When asked it will answer the front door and bring back the evening paper Or maybe it will do a spot of Hoovering in the lounge

Sounds far fetched? Not at all We have as they say the technology The only problem is price — until recently such a being would have cost tens of thousands of pounds

In the US, however there are now a number of manufacturers producing simple low-cost personal robots Hero from Heathkit/Zenith costs around £1 500 and is about 18 inches tall with a single gripping arm Heathkit are now selling around 140 robots a month

'Topo is a £630 robot produced by a company called Androbot The man behind Androbot is Nolan Bushnell — founder of Atari — who now has his eye on a new growth market

A mechanical claw . . .

One British company working along the same lines is Colne Robotics based in Twickenham, Middlesex "These machines are the first signs of the robot summer — it is going to be an enormous industry says Colne s founder John Reakie

John set up the company in August 1981 Prior to that he had spent 10 years designing medical instrumentation mainly for use in university research laboratories Unusually, John had a previous career as an investment analyst "I greatly regretted all that time talking investment rubbish so I changed and taught myself electronics

The aim of the new company is to develop a range of equipment which permits external control techniques to be applied to microcomputers "Once a person has achieved a degree of computer literacy" explains John "one of the first things they want to do is to externalise their control outside of the computer"

There is another reason why John chose robotics Products which involve only one discipline — ie purely electronic — are open to rapid competition from Japan and the far east "With Colne we are combining expertise in several areas — mechanical engineering, electronic hardware and electronic software — and reckon we have a better chance of keeping foreign competition at bay The software side is our best defence"

The first product designed and manufactured by Colne Robotics was Armdroid I in September 1981 It is a low cost — about £400 — robot arm which can swivel twist bend pick up and stack objects using its mechanical claw.

Armdroid I s are now being manufactured at a rate of about 50 a week Over 2 000 have been delivered — 90 percent overseas The Armdroid I will interface to most home micros — ZX81 Spectrum Vic20 Pet BBC RM 380Z Apple and Tandy — and is available with extensive software back-up

Since the Armdroid I, Colne has produced two other products — the Zeaker micro turtle and the Colvis computer vision system

Zeaker is a small two-wheeled device driven from the computer with sensors that can detect obstructions It has a horn and lights and with a pen underneath it can leave a trail Yet it costs only £79

There is now a range of software to go with it, and it is easily programmable in Logo — the turtle s language Again the unit will run from any of the popular home micros

Colvis vision system costs £400 and will work from any micro and can be connected to any robot. A 'camera designed by Colne sends information to the computer, which can be programmed to learn and recognise objects and shapes

In September Colne Robotics will launch its fourth product — Armdroid II — a heavy-duty version of Armdroid I for use mainly in industry It will be capable of a 2kg lift and will cost around £3,000 — a tenth of the cost of the competition

John sees its great potential as a satellite robot for larger robots "Imagine — a big robot on a car assembly line offering up car wheels on to cars really requires a satellite robot to position the nuts

Also this summer Colne will announce a computer-controlled lathe and mill which will sell for around £750 With a five-inch chuck and 22 inch bed it will sell mainly to colleges of further and higher education "The government has just announced a £5m scheme for colleges to buy computer controlled machine tools Like the micros in schools scheme it is a fifty-fifty grants arrangement but the scheme makes no recommendations of particular equipment because there isn't any yet — there will be in six weeks!



A little further in the future is perhaps John s most ambitious project — a low-cost personal robot It is a wheeled, stepper-motor driven, four foot high device with a carrying platform one five-axis arm and a moveable head It will be radio-controlled from any home micro and be capable of voice recognition and generation, infra-red sensing of people and ultra-sonic sensing of distance Its own on-board microprocessor will give it some intelligence but the learning control will come from the computer

'Designed for the home market — your own personal robot — it will build up in a series of modules" explains John

"You will start off with the basic device — the wheeled platform with power supply controlled by radio from your home computer — for about £150 Then you will be able to add extra facilities with a rack that will take a range of standard printed-circuit boards"

Obsolete humans?

By the time you have added on all the goodies the total cost should come out at around £750 — about the same as the average Atari or BBC computer owner spends by the time they have added on discs printers and so on

With a £150 starting price people will be able to afford it, whereas they might not if they had to buy the whole thing straight off," says John

Exciting indeed And there is no reason why Colne should not follow through The company has recently received substantial financial backing from Prutech — the same high technology investment company that backs Dragon Data Says John "Thirty five percent of our capital is owned by Prutech and we expect to develop very quickly from now on We have just set up a sub division in Florida, manufacturing the Armdroid I for the US market"

What I want to know is — will the Colne Personal Robot be capable of locating and recharging itself from an electric power point? If so what use will it have for obsolete things like humans? ■

Graphically illustrated!

***Graham Taylor** looks at some of the graphics software available for home micros*

But does it have good graphics? the home computer buff's perennial question when faced with some new wizzo games to end all games

Rightly or wrongly graphics are one of the most important features affecting sales in the home computer market. But, what do the popular micros have to offer — how do they compare? And, given that you've bought the damn thing what can you get to beef it up?

Whatever its strengths — and there are many of them — the Dragon 32 is not renowned for its graphics For the beginner, the various modes make it far from simple to mix high resolution and text Nevertheless, it can be done and if you want to prove it for yourself, take a look at Salamander s *Graphics System* or Wintersoft's *Artist Designer*

When Run, the Salamander program presents you with a help page which lists the various commands available You can then choose the mode for drawing and within the restrictions of that mode the colour combination

A flashing target can be moved around the screen using a joystick When the position is right pressing a key will draw a box an arc a line a circle or even a polygon with up to eight sides

Having designed your picture (which somehow always ended up looking like something by Paul Klee in my case) you may want to claim authorship By pressing *T* you can move a box cursor using the joystick to place text on the screen in any of the four arrow directions - text with resolution it can be done!

It is great fun to play about with the various modes and see how your design changes under each one — it's also very instructive

If I have one criticism, it is with the *Fill* command, which paints in your shape This tended to be a little unreliable and sometimes produced an error report, which could be infuriating to people using the program "seriously" to create a picture rather than merely playing around

Nevertheless I would recommend the package to anyone with a Dragon as very good value for money

Wintersoft s *Artist Designer* offers very similar features including the text facilities In general I would rate it just as good value as the Salamander package and in fact I had rather less trouble with the *Paint* command My only reservation is that it is a little less easy to familiarise yourself with it

In a different league is the *Hi res* cartridge from Compusense At £25 30 it won t be the sort of thing you rush out to buy immediately

What do you get for all that money? The cartridge comes with a 16 page explanatory booklet, but the difference is obvious as soon as you switch on — the screen has grown!

In fact, the hi-res cartridge more than doubles the screen size to a 51 x 24 character/line display You can print on this new screen using a new command *Print!* which works exactly like *Print@* but has 1224 positions

Perhaps more impressive still is *Print%* — this command allows you to place an 8 x 8 bit sprite in any one of 49152 positions A total of 224 sprites can be defined and moved around the screen

The cartridge comes with nine international character sets, including Danish and Japanese It uses the high resolution screen area on the Dragon which leaves you with 20 000 bytes for programs

Its demise has been predicted

Although its demise has been predicted for months the Vic20 is still selling well and should continue to do so unless the Commodore 64 drops in price

Early Vic games all tended to have very "chunky" low resolution, graphics Admittedly it is possible to buy the super expander which offers very good high resolution graphics but only a low percentage of Vic owners have actually done so — perhaps because there is little commercial software that makes use of it

However recent Vic games have



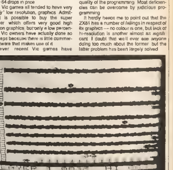
proved that even on the unexpanded model dazzling displays are possible *Wacky Waiters* is one example, but perhaps the most impressive game I've seen graphically on the Vic is *Mutant Herd* — one of Thorn EMI s range of cartridges

You must use a pair of crossed laser beams to guide your mutant slayer into the mutants burrows at the same time herding the mutants away from the pulsating powerhouse Assuming you manage that bit, then you must guide your slayer down into the burrows to destroy the 15 mutant eggs and their Queen avoiding the falling rubble

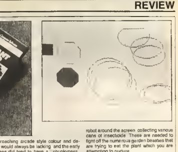
The game itself is great fun and the movement of the creatures especially the Mutant Queen is lively and entertaining

The message if you like is this — it is rarely the hardware that makes quality graphics impossible it is more often the quality of the programming Most deficiencies can be overcome by judicious programming

It hardly needs me to point out that the ZX81 has a number of failings in respect of its graphics — no colour is one, but lack of hi-resolution is another almost as significant I doubt that we'll ever see anyone doing too much about the former but the latter problem has been largely solved







The solution has taken the form both of fairly expensive add-ons and inexpensive software

High Resolundn is a cassette and a manual from Computer Rentals The program uses three-quarters of a K to provide a screen of 256 x 192 squares

For practical purposes this means that the program gives addressable graphics of 256 x 192 resolution In fact the ZX81 has only 128 codes for dot patterns but it achieves the pseudo resolution by finding the nearest one to a specified point

The "mini characters" can be used in an ingenious way — eight printed in succession will provide a user definable shape

Convulsions of an unpleasant kind

The only thing I would print out is that this program is for fairly sophisticated users — it works by calling machine code routines and screen positions which have to be *Poked* Nonetheless it is a most ingenious program that is highly recommended There are surprisingly few editor/designer type packages for the Spectrum perhaps because the free *Horizons* cassette contains both a character creator and an artist sketchpad program

The Spectrum is perhaps the best example of software overcoming the deficiencies of hardware

As the advertisements say the Spectrum has high resolution higher in fact than the Dragon, and you can freely mix text and graphics in even the simplest Basic program What they don't say is that the colour resolution is considerably lower and each of the 21 by 31 squares can only support two colours

This means that, for example drawing pie charts is nearly impossible as the line marking the boundary of each slice is bound to cut across several such squares When you try to fill in that segment's colour, the neat hi resolution edge will become a jagged series of steps

This ought to mean that anything approaching arcade style colour and detail would always be lacking and the early games did tend to have a "chunkyness" about them However, it soon became clear that surprising things could be achieved when the *Horace* series appeared *Horace* could be moved animatedly around the screen without any apparent colour resolution problems at all

Other attempts suffered from "flicker", so that spaceships etc, appeared to be undergoing convulsions of a particularly unpleasant kind as they moved across the screen

With *Arcadia* and now *Ah diddums* Imagine reduced the flicker to a shudder But my vote for best graphic achievement in a Spectrum game goes to *Psst* from Ultimate Play the Game

The idea of the game is to move a little robot around the screen collecting various cans of insecticide These are needed to fight off the numerous garden beasties that are trying to eat the plant which you are attempting to nurture

The slugs spiders and wasps not only look realistic they move in highly individual ways Should your plant remain uneaten, it will prosper and eventually bloom into a blaze of colour

Maybe *Psst* represents the most that can be achieved with the hardware — I don't know — but it illustrates wonderfully the point if you like of this article With ingenuity even serious defects in hardware can be overcome and by extension, the precise details of a new computer will matter less and less to the potential buyer while the quality of its software will become even more important ■

Firm	Program	Micro	Price
Wintersoft 101 Westminster Bridge Road London SE1 7HR	*Artist's Designer*	Dragon 32	£6 99
Salamander Software 27 Ditchling Rise Brighton East Sussex	*Graphics System*	Dragon 32	£9 95
Computer Rentals 140 Whitechapel Road London E1	*High Resolution*	ZX81	£5 95
Compusense PO Box 155 London N13 5XA	*Hi res*	Dragon 32	£25 30
Ultimate Play the Game The Green Ashby de la Zouch Leicestershire LE6 5JU	*Psst*	Spectrum	£5 50
Thorn EMI Video Thorn House Upper St Martin's Lane London WC2	*Mutant Herd*	Vic20	£20 00

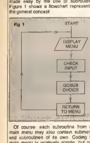
What's on the menu?

***Bob Skinner** looks at the problems involved in designing an interactive program*

Designing an interactive program almost invariably means that you will have to give the user a number of choices as to the operations to be followed by the program For example continue with the current process, exit from the current situation or skip to another section Such a decision point, at which the program may branch according to the user's choice, is often termed a menu

It is frequently a good idea to present a master menu towards the beginning of a program, from which the user may select a course of action and to which the user is returned at the end of the action chosen The task of programming such a menu is made easy by the use of subroutines. Figure 1 shows a flowchart representing the general concept

Fig 1



Of course each subroutine from the main menu may also contain submenus and subroutines of its own Coding the main menu is relatively simple, but note that we need to check the user's input choice for illegal values

Figure 2 shows one way of coding the general algorithm.

Fig. 2

```
10 CLS                                 clear the screen
20 PRINT  MAIN MENU"                   title
30 PRINT                               print a blank line
40 PRINT  1   SEARCH FILE"
50 PRINT  2   ADD NEW DATA
60 PRINT  3   AMEND DATA   options
70 PRINT  4   DELETE ENTRY
80 PRINT  5   END
70 A$ INKEY$ A = VAL(A$)               read keyboard
80 IF A<1 OR A>5 THEN GOTO 70          trap illegal values
90 ON A GOSUB 200 300 400 500          perform subroutine
100 IF A=5 THEN CLS END                terminate if required
110 GOTO 10                            repeat process
```

Following the flow of control in this example note that the program will ignore any key press other than the numbers 1 to 5 inclusive Once the chosen subroutine has been executed (ie a *Return* statement has been encountered) the program returns to line 100, from where control passes to the start of the menu The process is then repeated, unless *A=5* in which case the *On Gosub* statement will be ignored and line 100 will terminate the program Notice the use of *On Gosub* to avoid too many *If Then* statements to get to the subroutines

This technique can be extended to include several options This is where *On Gosub* really saves space and makes the code more readable than lines like

```
90 IF A=1 THEN GOSUB 200
92 IF A=2 THEN GOSUB 300
94 IF A=3 THEN GOSUB 400
96 IF A=4 THEN GOSUB 500
   and so on
```

A 'tree' diagram of Figure 1 would look something like Figure 3, which shows clearly the 'Top-Down Structured Programming' approach to program design (*Popular Computing Weekly* 5-11 May) In fact, this is how all program design should start, with a general chart of the overall structure of the main parts of the program Each section can then be detailed, first by flowcharting then by coding into the language required This allows a modular approach wherein each subroutine has a specified function, is given certain values when called performs some task and possibly returns values to the part of the program which called it

We want to prompt the user to enter two numbers (*N1* and *N2*) then to choose from a menu which mathematical function he/she wishes to be applied to those numbers Let us use the four functions

FUNCTION DESCRIPTION
i) (N1 + N2) * (N1 + N2) — SQUARE OF SUM
ii) (N1 * N1) + (N2 * N2) — SUM OF SQUARES
iii) (N1 * N1) * (N2 * N2) — PRODUCT OF SQUARES
iv) (N1 * N2) / (N1 + N2) — PRODUCT SUM RATIO

For the main menu all we have to do is to replace the prompts in lines 40, 50 60 and 70 with the descriptions given in the table and insert a line to get the user's two numbers

```
12 PRINT  ENTER TWO NUMBERS
14 INPUT N1$ N1 = VAL (N1$)
16 INPUT N2$ N2 = VAL (N2$)
18 CLS
```

Notice that the two numbers are entered as strings rather than numbers This is to prevent the interpreter breaking in with an error message like *Redo from start* should the user enter non-numeric characters

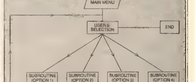
We now need to flowchart the four subroutines Essentially, what we want to do is to give the relevant subroutine the variables *N1* and *N2* (which is done automatically) and to get an answer (a number) back. That is, each subroutine will have the form

DATA PROCESS OUTPUT
N1 N2 → SUBROUTINE → RESULT

In fact the subroutines will have very similar formats when coded

```
200 C$= SQUARE OF SUM
210 R = (N1 + N2) * (N1 + N2)
230 RETURN
```

Fig 3



To show how this works in practice, let us look at the design of a simple program to do some maths We will use the principle outlined above

```
300 C$= SUM OF SQUARES
310 R = (N1 * N1) + (N2 * N2)
320 RETURN
```

continued on page 18

```
400 C$="PRODUCT OF SQUARES"
410 R = (N1 * N1) * (N2 * N2)
420 RETURN

500 C$ = PRODUCT-SUM RATIO"
510 TV = N1 + N2
520 IF TV = 0 THEN R = 0
530 IF TV = 0 THEN GOTO 550
540 R = (N1 * N2) / TV
550 RETURN
```

It is vital to check (line 520) in any division that the divisor will not be zero If it were the program would crash and the interpreter report *Division by zero*

Finally, we want to see the result and, after letting the user check the answer, return him to the main menu

```
102 PRINT  NUMBERS WERE  N1 ' AND " N2
104 PRINT  CALCULATION OF  C$
106 PRINT  RESULT IS  R
108 PRINT  PRESS SPACE TO CONTINUE
109 A$ = INKEY$ IF A$<>CHR$(32) THEN 109
```

Line 104 prints the name of the subroutine that has just been completed this is a useful programming technique which can greatly aid debugging programs

Putting these modules together gives us the complete program, which should really be tidied up by renumbering ■

The program was written for the Dragon 32, but it is designed to be easy to convert for all micros.

```
10 CLS

12 PRINT "ENTER TWO NUMBERS"
14 INPUT N1$:N1 = VAL(N1$)
16 INPUT N2$:N2 = VAL(N2$)
18 CLS

20 PRINT "MAIN MENU"
30 PRINT
40 PRINT "1...SQUARE OF SUM"
50 PRINT "2...SUM OF SQUARES"
60 PRINT "3...PRODUCT OF SQUARES"
70 PRINT "4...PRODUCT-SUM RATIO"
80 PRINT "5...END"
70 A$=INKEY$:A=VAL(A$)
80 IF A<1 OR A>5 THEN GOTO 70
90 ON A GOSUB 200,300,400,500
100 IF A=5 THEN CLS: END

102 PRINT "NUMBERS WERE ";N1;" AND ";
    N2
104 PRINT "CALCULATION OF ";C$
106 PRINT "RESULT IS:";R
108 PRINT "PRESS SPACE TO CONTINUE"
109 A$ = INKEY$:IF A$<>CHR$(32) THEN
    109
110 GOTO 10

200 C$="SQUARE OF SUM"
210 R = (N1 + N2) * (N1 + N2)
230 RETURN

300 C$="SUM OF SQUARES"
310 R = (N1 * N1) + (N2 * N2)
320 RETURN

400 C$="PRODUCT OF SQUARES"
410 R = (N1 * N1) * (N2 * N2)
420 RETURN

500 C$ = "PRODUCT-SUM RATIO"
510 TV =  N1 + N2
520 IF TV = 0 THEN R = 0
530 IF TV =0 THEN GOTO 550
540 R = (N1 * N2) / TV
550 RETURN
```

Over the moon!

***Maurice Gavin** presents a program to show all the phases of the moon's orbit around the earth*

The moon is our nearest neighbour in space and its influence has been ingrained upon us from antiquity Witness the words "Monday, month' and even "lunacy

For many, a silvery full moon riding high in winter or a golden crescent in the western sky at dusk is a splendid sight Our moon, like all the other planets and satellites in the sun s family is a globe shining by reflected sunlight The following program, for 16K Spectrum, explains how the moon's appearance changes throughout the month

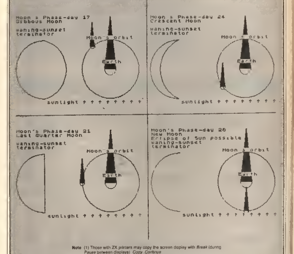
This program has a split display showing the phases and daily motion of the moon about the earth It demonstrates eclipses of the sun and moon and shows why a total eclipse of the sun, for any given place on earth is very rare

Each phase of the waxing and waning moon is described via the conditional *Print* statement in lines 25, 26 and 27 The bright limb or edge "nearest ' to the sun is *Drawn* first (*L 40*) where *Pi* = a semicircle and then the terminator or sunrise/sunset line (*L 70, 80*) The latter is actually a semi-ellipse and not a simple arc *Drawn* so rapidly by the Spectrum

The program accurately shows the foreshortening affect as the terminator approaches the limb at new or full moon

Once Run a complete monthly cycle is shown The program invites the entry of any selected day or decimal day for display The economical conditional *Goto* on line 210 automatically reruns the program if a day < *0 or* > *28* is entered!

Colour and sound can be added to taste and will not affect the technical accuracy of the presentation ■



Note (1) Those with ZX printers may copy the screen display with *Break* (during *Pause* between displays) *Copy Continue*
(2) The display may be speeded up by holding any key to cancel the *Pause* statement L90

```
   1 REM
Moon's Phases © Maurice Gavin 83
   4 LET G=192  LET H=69  LET J=
58  LET K=62  LET M=128  LET Z=0
   5 REM ---------------------------
          0 to 28 days=mainloop
------------------------------------
   6 FOR D=0 TO 28
   7 REM ---------------------------
          draw Earth & Moon orbit
------------------------------------
   8 CLS   CIRCLE G,H,J. CIRCLE
G,H,12
   9 REM ---------------------------
          draw Moon in orbit
------------------------------------
  10 LET P=PI  LET A=(D-7)/14*P
  11 LET C=G+J*COS A  LET E=H+J*
SIN A. CIRCLE C,E,5
  12 REM ---------------------------
          draw Moon's shadow
------------------------------------
  13 FOR N=.8 TO 5  PLOT C+N,E
DRAW 0,K-10*N  PLOT C-N,E. DRAW
0,K-10*N  NEXT N
  14 REM ---------------------------
          draw Earth's shadow
------------------------------------
  15 FOR N=.5 TO 12  PLOT G+N,M
 DRAW 0,M-9*N. PLOT G-N,M  DRAW
0,M-9*N  NEXT N
  18 REM ---------------------------
          describe Moon's phase
------------------------------------
  20 PRINT "Moon's Phase-day ",D
  23 PRINT FLASH 1,("New" AND (D
=0 OR D=28))+("1st" AND D=7)+("L
ast" AND D=21)+(" Quarter" AND (
D=7 OR D=21))+("Full" AND D=14)+
("Crescent" AND (D>0 AND D<7 OR
D>21 AND D<28))+("Gibbous" AND (
D<>14 AND D>7 AND D<21))+" Moon"
  25 REM ---------------------------
          eclipses & terminator
------------------------------------
  26 PRINT FLASH 1,( "Eclipse of
 Sun possible" AND (D=0 OR D=28)
)+("Eclipse of Moon possible" AN
D D=14)
  27 PRINT ("waxing-sunrise" AND
 D<14)+("waning-sunset" AND D>14
)  PRINT "terminator"
  28 PRINT AT 11,22,"Earth",AT 5
,18,"Moon's orbit"
  29 PRINT AT 21,5,"sunlight ↑ ↑
↑ ↑ ↑ ↑ ↑ ↑"
  30 REM ---------------------------
          draw bright limb
------------------------------------
  35 IF D>14 THEN LET P=-P
  40 PLOT J,10  DRAW 0,J*2.P
  45 REM ---------------------------
          draw terminator
------------------------------------
  50 LET S=D-7  LET X=2.5
  60 IF S>7 THEN LET S=S-14
  70 LET N=X*ATN (PI/180*-S*28)
  80 PLOT J,10  DRAW 0,J*2,N
  82 REM ---------------------------
          jump out of loop(z=1)
------------------------------------
  85 IF Z=1 THEN GO TO 200
  90 PAUSE 300  NEXT D  LET Z=1
 200 INPUT "Select day ";D
 205 REM ---------------------------
          if D<>0 to 28 goto 1
------------------------------------
 210 GO TO (D>=0 AND D<=28)*8
9900 REM ---------------------------
          save & autorun
------------------------------------
9990 SAVE "moon" LINE 1
```

Command performance!

***Keith and Steven Brain** present the Pic-man's guide to graphic commands*

The Dragon 32 uses Microsoft Extended Color Basic, which features a very versatile set of hi-resolution graphics commands. But, while these commands are very powerful they can be somewhat overpowering to the novice.

In an effort to explain more clearly the syntax and application of the Dragon graphics commands, we have therefore enlisted the help of our friend the *Pic man*. Perhaps we should explain that he is quite unlike his abbreviated relative *Pi-man*, in that he is definitely not an automaton and certainly has no political aspirations (hence his appearance in glorious black and white). And, unlike *Pac-man*, he has no fear of ghosts or insatiable appetite for power pills. Instead, he has deliberately been constructed from a wide assortment of graphics commands so that he demonstrates how you can use most of the available hi-resolution drawing commands.

Start by setting the *Pmode* to *4*, so that you have the highest possible resolution and can therefore add lots of fine detail. *Screen 1,0* gives us white on a black background.

```
10 PMODE 4 1 SCREEN 1 0 PCLS
```

In its simplest form, the *Circle* command only needs two parameters: the *X* and *Y* screen co-ordinates of the centre, and the diameter of the circle, so that will do nicely for a pair of small round eyes. Remember that co-ordinates are always specified on a 256 × 192 grid, no matter which *Pmode* you are using.

When planning a design you can use graph paper or fancy plotting sheets, but a trial and error approach on the screen is often quicker where there is a lot of fine detail to squeeze in. There is no need to specify anything else as the default values (values automatically used by the Dragon if you don't set any others) will give you a full round *circle* in the foreground colour.

```
40 CIRCLE(79 84),2
50 CIRCLE(86 84),2
```

Heads are not actually round but rather egg-shaped (especially if you are a micro-maniac), so for that we need to form a vertically-distorted ellipse with *Circle*. It is the height/width (*H/W*) ratio which allows you to include this distortion, but note that this must be the *fourth* parameter.

It is very easy to forget that the system can only tell which is the fourth item if it can already see three other parameters — therefore you must now also include the third parameter (colour). Although we have actually put the number 1 in to set the colour to white, the computer will also recognise a comma on its own as the default value, so either of the following lines has the same effect. In this program we have deliberately included all the actual values to make it easier to read. The *H/W* ratio is greater than *1*, so that distortion is vertical rather than horizontal.

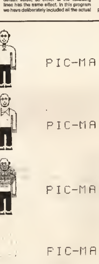
```
30 CIRCLE(82 54) 8 1 1 5
30 CIRCLE(82 54) 8 .1 5
```

A further feature of *Circle* is the ability to form only certain arcs of the whole circle, using parameters five and six to set the start and finish. *Pic-man* is smiling, so his mouth is the bottom half of a circle which is only drawn from 0 (three o'clock) to .5 (nine o'clock).

```
70 CIRCLE(82 56) 3 1,1,0 .5
```

The simplest sort of *Line* just goes from one point to another, as in the nose, and *Pset* rather than *Preset* means that white (the foreground colour) is used.

```
80 LINE(82 52) – (82,54) PSET
```



Although his ears may look positively princely, they are rather too small to form with *Circle*, so they are simply boxes formed by specifying the top left and bottom right corners and adding *B* to the end of the *Line* command. The neck is made the same way.

```
80 LINE(73 46) – (74 49) PSET B
90 LINE(90 46) – (91 49) PSET B
100 LINE(80 61) – (84 63) PSET B
```

Now we have a neck, we can add the round-shouldered look by a combination of all the previous *Circle* ideas to give the top half of a horizontally-distorted ellipse.

```
110 CIRCLE(82 72) 18 1 .5 .5,1
```

We could have continued to use *Line* to draw the rest of his body, but *Draw* is more versatile as a whole series of lines in different directions can be *Drawn* at the same time. First, the top half of the body

```
120 DRAW" BM64 72D28R6U24R2D2-8R28U2
     8R2D24R6U28"
```

and then the bottom

```
130 DRAW" BM72 97D30R6U20R4D2-0R6U30"
```

Note the use of blank moves (*BM*), to set the starting position, and make sure you follow the instructions round to see which way they go. It is best to try to plan your route carefully so that it is as compact as possible. You must also always remember that the next *Draw* command will normally start from the last point *Drawn*, even if that was done an hour or more ago (as long as you don't use *Run*). So, if things start going haywire in your programs, look back and check what was the last thing *Drawn*!

Draw can be used to make any sort of design and it is very useful in putting text on the high-resolution screen. The let-

Continued on page 25

ters forming the title *Pic-man* are *Drawn* in this way (for more details of this technique see *Dragon 32 Games Master*)

```
20 DRAW"BM150,100S8U6R3FDGL3BM+8,+3R2LU6LR2BM+5,+6HU4ER2FHL2GD4FR2E8M+2,-2R4BM+2,+3U6F2E2D6BM+4,+0U5ER2FD5U3L4BM+8,+3U6DF4DU6S4"
```

Pic-man obviously favours Doc Marten's as his boots are quite massive top halves of *Circles* with thick soles formed by boxes *Filled* with the foreground colour

```
140 CIRCLE(76,132),5,1,1,.5,1
150 CIRCLE(98,132),5,1,1,.5,1
160 LINE(71,132)-(81,134),PSET,BF
170 LINE(93,132)-(93,134),PSET,BF
```

To make him look more solid, we have *Painted* in his trousers. *Paint* will fill an area with the first specified colour until it reaches the second specified colour — the main user difficulties are making sure you set the right co-ordinates and that there are no holes through which *Paint* can leak. Try altering the co-ordinates in line 180 and watch what happens

```
180 PAINT(74,100),1,1
```

Draw always acts on a string, but this string can also be defined in advance and used repeatedly. As we have two identical hands to *Draw*, these have first been defined as *H$*

H$ also uses another useful parameter called 'no update' or '*N*'. Normally each new *Draw* command continues from where the last line *Drawn* ended, but if you put *N* in front of a command then the next line is *Drawn* from the same place as the current one. Follow the sequence carefully to see how each finger is formed (his thumbs are out of sight in case you think he is deformed)

```
190 H$="ND5R2ND5R2ND5R2ND5"
```

To put the hands into the appropriate positions, we just need to set the screen start position and then execute *H$* by sandwiching it between '*X*' and ';'

```
200 DRAW"BM64,100XH$;"
210 DRAW"BM94,100XH$;"
```

We are afraid that *Pic-man* is really rather pompous and has taken to wearing the bow tie defined in *A$*. Notice that this is *Drawn* from the centre using some of the diagonal commands (*F* and *G*) and that it is deliberately asymmetrical.

A relative blank move is used to separate the final short stripe from the rest of the picture. This has the advantage that you do not have to calculate the actual position, but only the displacement from the current position as + and − a number of screen points. It is not usually essential to start *Drawing* a design from the centre, but in this case *Pic-man* wants to prove to you that this is actually a revolving bow-tie, which grows, so he needs a central point to work from

```
220 A$="BM82,69F3U6G6U6F3BM+1,+0R2":S=4
```

The scale parameter '*S*' sets the size of the string *Drawn*, the angle parameter '*A*' allows you to change the direction of *Drawing* by 90 degree steps and the colour parameter '*C*' allows you to change the colour of *Drawing*. You can use a variable to change any of these, provided that you first convert the variable to a string with *Str$*. All these ideas have been combined together in this little sequence in which the tie is *Drawn* in colour 1 and then colour 0 (ie, drawn and erased), in all possible directions and at ten different increasing scales. The sound is included to slow things down so that the movement can be clearly seen

```
230 DRAW"S"+STR$(S)
240 FOR N=0 TO 3:DRAW"A"+STR$(N)
250 FOR M=1 TO 0 STEP-1:DRAW"C"+STR$(M)+A$
260 SOUND255,1:NEXT M,N
270 S=S+1:IF S<10 THEN 230
```

Of course, pride always comes before a fall and that rotating tie looks very dangerous, so it is hardly surprising that it eventually explodes. Explosions are very frequent features of computer programs, so this is a very general routine. A series of expanding concentric *Circles* are drawn by using the variable '*X*' to set the diameter — a sound is integrated with each expansion of the circle. *Play* is used instead of *Sound* as it allows the use of a much shorter duration if tempo (*T*) and note-length (*L*) are set to their highest values (255)

```
280 FOR X=1 TO 59 STEP 2:CIRCLE(82,69),X,1:PLAY"T255L255CD":NEXT X
```

Once it has passed its peak, the explosion dies away as the *Circles* are now drawn in reverse order by *Step−1*, so that only *Pic-man's* boots and a few fragments remain. Notice that integration of graphics and sound is more complete here as *X* also varies the volume and tempo of the *Play* command

```
290 FOR X=59 TO 1 STEP-1:CIRCLE(82,69),X,0:PLAY"L255V"+STR$(INT(X/2))+"T"+STR$(X*4)+"DC":NEXT X
```

■

```
FULL LISTING FOR 'PIC-MAN'

10 PMODE 4,1:SCREEN 1,0:PCLS
20 DRAW"BM150,100S8U6R3FDGL3BM+8
,+3R2LU6LR2BM+5,+6HU4ER2FHL2GD4F
R2E8M+2,-2R4BM+2,+3U6F2E2D6BM+4,
+0U5ER2FD5U3L4BM+8,+3U6DF4DU6S4"
30 CIRCLE(82,50),8,1,1.5
40 CIRCLE(79,48),2
50 CIRCLE(84,48),2
60 LINE(82,52)-(82,54),PSET
70 CIRCLE(82,55),3,1,1,0,.5
80 LINE(73,46)-(74,49),PSET,B
90 LINE(90,46)-(91,49),PSET,B
100 LINE(80,61)-(84,63),PSET,B
110 CIRCLE(82,72),18,1,.5,.5,1
120 DRAW"BM64,72D20R6U24R2D20R20
U20R2D24R6U28"
130 DRAW"BM72,97D30R9U20R4D20R8U
30
140 CIRCLE(76,132),5,1,1,.5,1
150 CIRCLE(98,132),5,1,1,.5,1
160 LINE(71,132)-(81,134),PSET,B
F
170 LINE(93,132)-(93,134),PSET,B
F
180 PAINT(74,100),1,1
190 H$="ND5R2ND5R2ND5R2ND5"
200 DRAW"BM64,100XH$;"
210 DRAW"BM94,100XH$;"
220 A$="BM82,69F3U6G6U6F3BM+1,+0
R2":S=4
230 DRAW"S"+STR$(S)
240 FOR N=0 TO 3:DRAW"A"+STR$(N)
250 FOR M=1 TO 0 STEP-1:DRAW"C"+
STR$(M)+A$
260 SOUND255,1:NEXT M,N
270 S=S+1:IF S<10 THEN 230
280 FOR X=1 TO 59 STEP 2:CIRCLE(
82,69),X,1:PLAY"T255L255CD":NEXT
 X
290 FOR X=59 TO 1 STEP-1:CIRCLE(
82,69),X,0:PLAY"L255V"+STR$(INT(
X/2))+"T"+STR$(X*4)+"DC":NEXT X
300 I$=INKEY$:IF I$="" THEN 300
```

Teaching turtle . . .

***Boris Allan** completes his two-part series on turtle graphics*

The potential of turtle graphics is immense from the writing of graphics games to the teaching of mathematical and arithmetical ideas I will see how the procedures can be used in games later (after I have shown how we can have more than one pen colour at a time) but this week I want to show how the turtle graphics routines can be used to produce useful effects in teaching

The first of the procedures is *Procspiral* has two parameters The routine draws spirals where each side gets *Inc* bigger at each linear portion After each line the turtle turns through *A* degrees to produce remarkably different effects

Try *Procspiral (60 1)* and a hexagon builds up to fill the screen while *Procspiral (60 2)* results in a hexagonalish shape that is now clearly a spiral *Procspiral (61 2)* produces an effect which looks remarkably like a spiral rush mat

Trying to explain why changing the angle by one degree (from 60 to 61) should make such a dramatic change, leads on to the idea of prime numbers, and divisibility *60* goes into 360 exactly, whereas the prime number 61 does not (and all prime numbers greater than five are divisible into 360, but most non prime numbers are divisible into 360 or some low multiple $360 = 2^3 \times 3^2 \times 5$) A great deal of fun can be had predicting what the spiral will look like eg is the 'inner spiral going to appear to be clockwise or counter-clockwise?

The next procedure *Procsinfn* also provides fun, but it s probably more applicable at the secondary level — variants can easily be produced to help in the teaching of polar geometry What is actually plotted is the locus of the curve $r = sin(\theta/k)$ which, depending on the value of the constant k, produces a circle ($k = 1$) a cardoid (or "heart) ($k = ½$), rather more complex looping curves (k at smaller values, try minus values) and then variants on "propeller shapes '

The parameter *Size* sets the size of the plot and the parameter *Factor* corresponds to k (and values can be entered as, eg, ⅓) Find out what happens when *Cos* is exchanged for *Sin*, and more complex variants

The three final procedures are used to produce Kasner snowflakes (see *Mathematics and the Imagination*, by E Kasner and J Newman, p 296-302) The only drawing is performed in *Prockasner* when the order of the curve (*Oder*) has reached zero, otherwise a recursive call is made to *Procrecursive* which actually then calls *Prockasner* *Procsnowfl* sets the scene by defining the order (*Oder*) and the size of each little step (*Inc*)

What happens with the procedure is seen by running the program for different orders (0 and upwards) The snowflake and similar curves (see Kasner and Newman) have many intrinsically interesting features eg the snowflake (as the order increases) is held to have an infinite perimeter but a finite area Kasner and Newman suggest investigating the anti snowflake where in *Procrecursive* the angles are $A - 60$ and $A + 60$ (and not $A + 60$, $A - 60$) The recursive technique can also be used for other purposes ■

```
2510REM---------
2520DEF PROCSPIRAL(A,INC)
2530 LOCAL I
2540PROCCENTRE: REPEAT
2550PROCTURN(A): PROCMOVE(I,1):I=I+INC
2560UNTIL INKEY$(0)="F"
2570*FX15,0
2580ENDPROC : REM SPIRAL
2590REM-----------------------------
2600REM-----------------------------
2610DEF PROCSINFN(SIZE,FACTOR)
2620LOCAL I,MAX
2630IF FACTOR<=1 THEN MAX=180/FACTOR ELSE MAX=180-(INT(FACTOR/2)*2=FACTOR)*180
2640FOR I=1 TO MAX: PROCCENTRE: PROCTURNTO(I): PROCMOVE(SIZE*SIN(RAD(I*FACTOR))
0): PROCMOVE(0,1): NEXT I
2650ENDPROC : REM SINFN
2660REM-----------------------------
2670REM-----------------------------
2680DEF PROCKASNER(ODER,ANGLE,INC)
2690 PROCTURNTO(ANGLE)
2700IF ODER>0 THEN PROCRECURSIVE(ODER-1,ANGLE,INC) ELSE PROCMOVE(INC,1)
2710ENDPROC : REM KASNER
2720REM-----------------------------
2730REM-----------------------------
2740DEF PROCRECURSIVE(O,A,I)
2750PROCKASNER(O,A,I): PROCKASNER(O,A+60,I): PROCKASNER(O,A-60,I): PROCKASNER(O
,A,I)
2760ENDPROC : REM RECURSIVE
2770REM-----------------------------
2780REM-----------------------------
2790DEF PROCSNOWFL(ODER,INC)
2800PROCKASNER(ODER,60,INC)
2810PROCKASNER(ODER,-60,INC)
2820PROCKASNER(ODER,180,INC)
2830ENDPROC : REM SNOWFL
2840REM-----------------------------
2850REM-----------------------------
```

Open Forum is for you to publish your programs and ideas. Take care that the listings you send in are all bug-free. Your documentation should start with a general description of the program and what it does and then give some detail of how the program is constructed. We will pay the *Program of the Week* double our new fee of £6 for each program published.

Super Breakout

on Vic20

Super Breakout runs on the unexpanded Vic20 and uses some of its best features.

This version of the famous game has 1-5 levels with one objective — keep the ball in play and demolish the bricks.

If you get a high score this will be stored at each level.

Program notes

Lines	
10-90	Title page
100-190	Move ball with sound effects
200-290	Move bat. Note location 197 is peeked for key value
300-410	Game over and Hi score
2000-2180	Instructions in lower case

```
0 REM **(C)C.ANDERSON**          1982
10 GOSUB2000 POKE36879,106 PRINT"          " PRINT"    SUPER
BREAK* '
20 PRINT"                " PRINT"     C.ANDERSON   " SP=7680 CC=38400 SD=3
6874
25 V=SD+4 PRINT"      1982      ' PRINT"        "
30 PRINT"         LEVEL(1-5)
40 GETD IFG=0ORG>5THEN40
43 IFG=1THENB$="      " M=14
47 IFG=2THENB$="     "  M=15
50 IFG=3THENB$='    " M=16
60 IFG=4THENB$="   " M=17
70 IFG=5THENB$="  " M=19
80 POKE36879,14
100 PRINT"" FORI=2TO7 FORJ=1TO20  POKESP+J+I*22,207 POKECC+J+I*22,I NEXTJ,I
110 BL=6 BT=11 POKESD,240
120 A=1 B=8+(IANDBL) X=1 Y=1 BL=BL-1 IFBL=4THENBL=BL-1
130 POKE36877,0 FORI=1TO10 POKEV,15 FORJ=1TO10 NEXTJ POKEV,0 FORJ=1TO10 NEXTJ NE
XTI
140 IFBL=0THEN300
150 POKESD,0 POKESP+A+B*22,32
160 A=A+X B=B+Y
170 IFA=20ORA=1THENX=-X POKE36874,230 POKEV,15 FORO=1TO25 NEXT POKE36876,0
180 IFB=0ORPEEK(SP+A+B*22)=207ORPEEK(SP+A+B*22+22)=99THENPOKESP+A+B*22,32 Y=-Y G
OSUB1000
190 IFB>21THENPOKEV,15 POKE36877,240 FORER=1TO500 NEXT GOTO120
200 POKESP+A+B*22,81
210 IFPEEK(197)=29THENBT=BT-1
220 IFBT<0THENBT=0
230 IFPEEK(197)=37THENBT=BT+1
240 IFBT>MTHENBT=M
250 PRINT"                    "TAB(BT)B$ IFSC<285THEN150
300 FORI=1TO5 PRINT"        GAME OVER" FORJ=1TO200 NEXTJ NEXTI
310 PRINT"                 ' FORJ=1TO200 NEXTJ
320 SC=0 FORI=2TO7 FORJ=1TO20
330 IFPEEK(SP+J+I*22)=32THENSC=SC+(8-I)
340 NEXTJ,I
350 PRINT"            YOU SCORED"SC PRINT"       ON LEVEL"G IFSC=420THENPRINT"
       1
355 IFSC>HI(G)THENHI(G)=SC
360 PRINT"      HI SCORE ='HI(G) FORI=1TO2000 NEXT
370 PRINT"           PLAY AGAIN?" PRINT"          (Y* OR N)" POKE198,0
380 GETG$
390 IFG$="N"THENPOKE36879,27 PRINT"  POKESD,0 END
400 IFG$="Y"THEN30
410 GOTO380
1000 POKEV,15 POKESD,225 FORA1=1TO50 NEXT RETURN
2000 PRINT"INSTRUCTION'S (Y/N)'
2010 GETG$ IFG$=''"THEN2010
2020 IFG$="N'THENRETURN
2030 POKE36869,242 PRINT"THE OBJECT OF THE GAME",
2040 PRINT"IS TO KNOCK OUT AS
2050 PRINT"MANY OF THE MULTI-
2060 PRINT"COLOURED BRICK'S AS
2070 PRINT"POSSIBLE.
2080 PRINT" YOU HAVE FOUR BALLS
2090 PRINT"AND SIX WALL'S TO TRY
2100 PRINT'AND KNOCK OUT.
2110 PRINT" HI-SCORE'S ARE GIVEN
2120 PRINT"FOR EACH LEVEL.
2130 PRINT"
2140 PRINT"  K=
2150 PRINT'  E=
2160 PRINT'
2170 GETG$ IFG$=""THEN2170
2180 POKE36869,240 RETURN
```

Super Breakout
by C Anderson

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Rebound

on ZX81

This program has a very simple objective The player s piece '0 , starts near the top left hand corner of the screen and, by rebounding it off the various obstacles the player must reach the bottom right hand corner (screen position 20 30) after passing through the 'gate which randomly opens and closes

Once the player has reached the bottom right hand corner the time taken and the best time are displayed, and the player is invited to play again My best time is 29 seconds Instructions as to which keys to press are included in the program which is just under 3 5 kilobytes in length

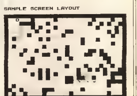
The program is written in three parts The first section between lines 1 and 217 is the initialisation routine I have used a string to hold the contents of the screen as I prefer this method when a full screen is needed The second section between lines 220 and 360 is the game playing routine In an attempt to make the program faster, the piece is *Poked* into the display file rather than *Printed* on to the screen The final section from line 2000 onwards prints out the instructions

Program notes

Line(s)	
3	Ensures the program auto-runs after Loading
10-150	Sets up the layout of the screen in the string
160	Discovers the address of the display file
210	Allows the user to print on the bottom two lines
217	Prints out screen
230	Decides which way the piece should move depending upon what key has been pressed This is a more concise method than five IF THEN statements
300	Will open or close the gate depending upon the value of RND
360-362	Print the time and the best time on to the bottom two lines
365-380	Flash the Game Over message on the screen and wait for key R' to be pressed before re-starting
2000-2050	Print out the instructions and wait for a key to be pressed
2060-2090	Once a key has been pressed the player is asked to wait for a few seconds The program then returns from the subroutine to set up the screen

```
   1 REM REBOUND 23.4.83
       (C) NEAL BLACKSHIRE
   2 LET BT=0
   3 SAVE "REBOUND"
   4 GOSUB 2000
   5 CLS
   6 FAST
  10 DIM S$(704)
  20 LET S$( TO 32)="■■■■■■■■■■■■■■■■■■■■■■■■■■■■■■■■"
  30 LET S$(673 TO 704)=S$( TO 3
2)
  40 FOR I=1 TO 673 STEP 32
  50 LET S$(I)="■"
  60 LET S$(I+31)="■"
  70 NEXT I
  80 FOR I=1 TO 125
  90 LET S$(INT (RND*640+32))="■
"
 100 NEXT I
 110 LET S$(664 TO 671)="       ■
"
 120 LET S$(633 TO 639)="      ■
"
 130 LET S$(600 TO 607)="       ■
"
 140 LET S$(568 TO 576)="       ■■
■"
 150 LET S$(34 TO 35)=" O "
 160 LET D=PEEK 16396+256*PEEK 1
6397
 170 LET P=D+37
 185 LET HOME=D+681
 190 LET T=0
 200 LET M=1
 210 POKE 16418,0
 215 SLOW
 217 PRINT S$
 220 LET I$=INKEY$
 230 LET M=(M AND I$="")+(VAL "1
" AND I$="Q")+(VAL "33" AND I$="
A")+(VAL "34" AND I$="P")+(VAL "
32" AND I$="L")
 240 IF PEEK (P+M)<>CODE " " THE
N LET M=-M
 250 IF PEEK (P+M)<>CODE " " THE
N GOTO 280
 260 POKE P,CODE " "
 265 LET P=P+M
 270 POKE P,CODE "O"
 280 POKE VAL "655"+D,(CODE "■"
AND RND<.5)+(CODE " " AND RND>=.
5)
 320 LET T=T+1
 340 IF P=HOME THEN GOTO 360
 350 GOTO 220
 360 PRINT AT 22,0,"YOU TOOK ";T
;" SECONDS"
 361 IF T<BT THEN LET BT=T
 362 PRINT AT 23,0,"BEST TIME=";
BT
 365 PRINT AT 10,10,"■■■■■■■■■",
AT 10,10,"GAME OVER"
 370 IF INKEY$="R" THEN GOTO 4
 380 GOTO 365
2000 CLS
2010 PRINT AT 0,12,"REBOUND",TAB
 7,"BY NEAL BLACKSHIRE"
2020 PRINT ,,"THE AIM OF THE GAM
E IS TO MOVE  FROM THE TOP LEFT
OF THE SCREEN TO THE BOTTOM RIGH
T. YOU CONTROLTHE ""O"" BY THE F
OLLOWING KEYS."
2030 PRINT ,,"Q=MOVES HORIZONTAL
LY","A=MOVES VERTICALLY","P=MOVE
S DIAGONALLY RIGHT","L=MOVES DIA
GONALLY LEFT"
2040 PRINT ,,"YOU MUST REBOUND T
HE ""O"" OFF","THE OBSTACLES AND
 INTO THE        ENCLOSURE (WHEN T
HE DOOR IS       OPEN).",,"YOUR TI
ME IS DISPLAYED AT THE   END OF
EACH GAME.TO RE-RUN PRESS""R"" W
HEN THE ""GAME OVER"" MESSAGEIS
FLASHING."
2050 PRINT "■■■■■■■■■■■■■■■■■■■■■■
■■■■"
2060 LET I$=INKEY$
2070 IF I$="" THEN GOTO 2060
2080 PRINT AT 21,0,"■■■■■■■■■■■
■■■■■■■■■■■■■"
2085 FOR I=1 TO 50
2086 NEXT I
2090 RETURN
```

SAMPLE SCREEN LAYOUT



Rebound
by Neal Blackshire

Scrolling

on Dragon

In a recent edition of *PCW*, there was an article concerning sound on the Dragon. In this article it was mentioned that there are no scrolling facilities on the Dragon. With this in mind I have devised the following programs in assembly language. I have also given their Hex codes to make programming easier.

```
MACHINE CODE ON DRAGON

The following five machine code
routines are for manipulating
the high and low resolution
screens on the Dragon 32.

1) Low resolution left scroll.
8E 04 00                LdX £0400
A6 01        Loop       LdA X+1
A7 80                   StA,X+
8C 06 00                CmpX £0600
26 F7                   Bne Loop
39                      Rts

2) Low resolution right scroll.
8E 06 00                LdX £0600
A6 1E        Loop       LdX X-2
A7 82                   X-,StA X
8C 04 00                CmpX £0400
26 F7                   Bne Loop
39                      Rts

3) Low resolution down scroll.
8E 06 00                LdX £0600
A6 00        Loop       LdA X
A7 88 20                StA X+32
A6 82                   X+
8C 03 DF                CmpX £3DF
26 F4                   Bne Loop
39                      Rts

4) High resolution left scroll.

8E 06 00                LdX £0600
A6 01        Loop       LdA X+1
A7 80                   StA,X+
8C ** **                CmpX £****
26 F7                   Bne Loop
39                      Rts

Note. **** stands for the hex
code which is one higher than
the last address of the screen
in the PMODE in which you are
working.Get this information
from the small booklet supplied
with your Dragon.1E 00 in mode 4

5) High res right scroll
8E ** **                LdX £****
A6 1E        Loop       LdX X-2
A7 82                   X-,StA X
8C 06 00                CmpX £0600
26 F7                   Bne Loop
39                      Rts

Note. ** ** see note above.

Any of the above routines can
be loaded with the following
BASIC programme.

10 CLEAR 200,32000:A=32000
20 INPUT A£:IF A£="XX" THEN END
30 POKE A,VAL("&H"+A£):A=A+1
40 GOTO 20

Run this programme and enter the
Hex codes (in the left hand column)
in pairs and enter XX to end.
Run these programmes by
EXEC 32000
All the routines are relocatable.
```

Scrolling
by G Twist

Catch Me

on BBC

This program for the BBC Micro is a game to test your knowledge of the keyboard.

When run, the human is shown in the passageway, closely followed by a demon represented as a yellow square. The human must get all the way round the passage.

A letter chosen at random appears at the top of the screen which you have to copy to move round the passageway. But if you hit the wrong key, or if you did not hit the right key fast enough the demon will decrease the gap between you until it finally catches and eats you.

Five levels of play are provided, giving you from five seconds down to one second to hit the right key. In the program the random letters are provided only from the upper case alphabet but it is easily adapted to cover both upper and lower case letters and indeed numbers as well.

Variables used

D inputs the level of play
M is used to count correct hits
X Y G and H move the human round the screen
X1 Y1 G1 and H1 control the movement of the demon

Program notes

30 to 60	Gives instructions and inputs speed of play
80	Changes to Mode 5
90 to 110	Sets up the characters, line 110 being the victorious human with his hand in the air
120	Calls the *Procedure Procplay*
140 to 260	Defines *Procplay* which
150	Sets letter counter to 0
160	Sets a really random start else the initial game starts with the same sequence
170	Calls the *Procedure* to set up the board
180	Selects random upper case character
350 to 490	Set the moves of the human
500 to 630	Set the moves of the demon
640 to 750	Ends the game if the human is caught
760 to 860	Sets the scene if the human completes the course
870 to 910	Asks whether you want another game

PROGRAM OF THE WEEK

```
10  REM**CATCH_ME (c) J.L. WARD 1983
20 REM**A PROGRAM FOR THE BBC MICRO COMPUTER
30 MODE7
40PRINT''' This is a game to test both reaction and
knowledge of the keyboard.''''The yellow letter has to
be tapped onto the keyboard.  If you make a mistake
or you are too slow, the yellow square willcatch up
and swallow you"
50 PRINT''CHR$130; "There are 5 levels of play
from"''CHR$130;"      1(easiest) to 5(hardest) "
60      PRINT  ''CHR$129; "What level(1 to 5)
";INPUT '''A
70 IF A<1 OR A>5 THEN 60
80MODE5
90VDU23,224,28,28,8,127,8,20,34,65
100 VDU23,225,127,127,127,127,127,127,127,1
110 VDU23,226 156,92,40,31,8,20,34,65
120PROCplay
130END
140DEF PROCplay
150M=0
160 X=RND(-TIME)
170PROCboard
180P$=CHR$(64+RND(26))
190 M=M+1
200 COLOUR3:PRINT TAB(0,2)"TYPE THIS LETTER "
;COLOUR2:PRINT P$;
210 D=100*(6-A)
```

```
220 A$=INKEY$(0):IF A$="" THEN GOTO 220
230 PROCmove:GOTO 10
240 PROCcatch
250 GOTO 10
260 ENDPROC
270 DEF PROCboard
280 MOVE 50,100:DRAW 1250,100:DRAW 1250,850
290 DRAW 50,850:DRAW 50,100
300 MOVE 150,100:DRAW 1150,100:DRAW 1150,750
310 DRAW 150,750:DRAW 150,100
320 X=7:Y=7:X1=3:Y1=7:G=17:H=30:G1=18:H1=30
330 COLOUR2:PRINT TAB(X1,Y1);CHR$225;COLOUR1:
PRINT TAB(X,Y);CHR$224
340 ENDPROC
350 DEF PROCmove
360 PRINT TAB(X,Y)
370 IF Y=18 THEN X=X+1:GOTO 470
380 IF X=18 AND Y<30 THEN Y=Y+1:GOTO 470
390 IF Y=30 THEN PRINT TAB(18,30);
400 PRINT TAB(G,H);" "
410 IF G>1 THEN G=G-1:GOTO 440
420 IF G=1 THEN H=H-1
430 IF H=7 THEN PRINT TAB(6,7); VERY GOOD":PROC
victory:PROCrepeat
440 COLOUR1:PRINT TAB(G,H);CHR$224:GOTO 480
450 IF Y=30 THEN X=X-1:GOTO 470
460 IF X=1 THEN Y=Y-1
470 COLOUR1:PRINT TAB(X,Y);CHR$224
480 PROCcatch
490 ENDPROC
500 DEF PROCcatch
510 PRINT TAB(X1,Y1);
520 IF X1<18 THEN X1=X1+1:GOTO 560
530 IF X1=18 AND Y1<29 THEN Y1=Y1+1:GOTO 560
540 IF Y1=29 THEN PRINT TAB(18,30);" ":GOTO 570
550 IF X=18 AND Y=30 GOTO 570
560 IF X1=X AND Y1=Y THEN PROCcaught ELSE COLOUR
2:PRINT TAB(X1,Y1);CHR$225:GOTO 630
570 PRINT TAB(G1,H1);"
580 IF G1>1 THEN G1=G1-1:GOTO 600
590 IF G1=1 THEN H1=H1-1
600 PRINT TAB(G1,H1);CHR$225
610 IF X=18 AND Y=30 AND G=(18 OR 17) AND G1=1
THEN PROCcaught
620 IF H1=H AND G1=G THEN PROCcaught ELSE COLOUR 2:
PRINT TAB(G1,H1);CHR$225
630 ENDPROC
640 DEF PROCcaught
650 IF Y=30 PRINT TAB(X,Y);" ":GOTO 660
660 COLOUR 2:PRINT TAB(X,Y);CHR$225
670 COLOUR3:PRINTTAB(3,10);"YOU ARE CAUGHT"
680 FOR Z=64 TO 4 STEP -4
690 SOUND 1,-10,Z,2
700 NEXT
710 PRINTTAB(3,12);"YOU HAD ";H-6
720 PRINT TAB(3,14);" LETTERS RIGHT
730 PROCrepeat
740 ENDPROC
750 DEF PROCvictory
760 PRINTTAB(3,12);"YOU HAD ";H-6
770 PRINT TAB(3,14);" LETTERS RIGHT
780 X=1
790 FOR I=1 TO 10
800           SOUND 1,-15,X,1
810           FOR J=1 TO 80:NEXT J
820             SOUND 2,-15,X+48,1
830    NEXT I
840 PRINT TAB(G1,H1);
850 PRINT TAB(G,H);CHR$224
860 ENDPROC
870 DEF PROCrepeat
880 PRINTTAB(3,21);" ANOTHER GAME"
890 IF GET$="Y" RUN
900 CLS:END
910 ENDPROC
```

Catch Me

by J Ward

Red Carpet

on Spectrum

The idea of the game is to move about a maze of star shaped nebulas laying red carpet for the Queen. If you touch the carpet after it has been laid or if you touch the stars you will be destroyed by their burglar alarms.

As you are in space you carry on moving in the last direction keyed in. Full instructions and a high score facility are included in the program.

To save type *Save* "Red Carpet" *Line 1*

```
  5 LET hs=0
 10 PAPER 0: CLS : BORDER 0
 20 FLASH 0: OVER 0: INVERSE 0
 30 BRIGHT 0
 35 PRINT AT 10,0; FLASH 1; INK
 4;"STOP THE TAPE - PRESS ANY KE
Y": PAUSE 0: CLS
 40 PRINT AT 0,0; INK 7;"RED C
ARPET" for the 16K ZX Spectrum
''' By Gavin Devine ''Move Chri
s the carpet layer    about the
 maze laying the Queens Red Carpe
t,as she is about to   take her
first steps into the   stars.One
 problem The carpet andstars hav
e burglar alarms and   if Chris
touches them he will   be destro
yed.Use ''  z-Left   'x-Right''"c
-Down ' f-Up  ''Press  s' to sta
rt'
 45 PAUSE 500
 48 IF INKEY$<>"s" THEN GO TO 4
5
 50 RESTORE
 70 FOR f=USR "a" TO USR "b"+7
 80 READ a: POKE f,a
 90 NEXT f
100 LET s=0
120 PRINT : PRINT : PRINT INK 5
;"*******************************
***           *
 **  ** ********* * *********  **
 **  **          * * *          **
 **  ********** * * * ***********
**
 **  ****************************
**
 **  ****************************
***          *                 *
 **  **      *******    ********  **
 **  **            *    *         **
 **      * ***** * * * ****** *
 *******              *        ****
***       ******************
 **  **** *                * ****
**
*
130 PRINT INK 5; "**********
        ***********
                ****************
*********************"
140 LET a=18: LET b=10
145 LET e=-1: LET f=0
150 PRINT AT a,b; INK 7;"A"
160 BEEP .01,0: BEEP .01,1: BEE
P .01,2: BEEP .01,3: BEEP .01,4
: BEEP .01,5: BEEP .01,6: BEEP .0
1,7
170 IF INKEY$="z" THEN LET e=-1
: LET f=0
180 IF INKEY$="x" THEN LET e=1:
LET f=0
190 IF INKEY$="c" THEN LET f=1:
LET e=0
200 IF INKEY$="f" THEN LET f=-1
: LET e=0
210 PRINT AT a,b; INK 2;"■"
220 IF SCREEN$ (a+f,b+e)="*" TH
EN GO TO 250
225 IF ATTR (a+f,b+e)=BIN 00000
010 THEN GO TO 250
230 LET s=s+1: LET a=a+f: LET b
=b+e
235 PRINT AT 0,0; INK 7; INVERS
E 1;"SCORE=";s;" HI=";hs
240 GO TO 150
250 PRINT AT a+f,b+e; FLASH 1;
INK 6; PAPER 2;"B": FOR f=1 TO 2
0: BEEP .01,5: NEXT f: BEEP .1,1
0: BEEP .01,10
260 IF s>hs THEN GO TO 300
270 PRINT AT 21,0;"Instructions
<y/n> ?": INPUT a$: IF a$="y" T
HEN CLS : GO TO 40
280 CLS
290 GO TO 100
```

Continued on page 35

```
300 CLS : PAPER 0: CLS
310 INK 0
320 PRINT AT 1,3,"
330 PRINT AT 10,1,"
340 PRINT AT 17,1,"
" ",hs
350 PRINT AT 19,1,"
"
360 FOR f=1 TO 250: NEXT f
370 PRINT AT 17,1,"
"
380 FOR f=1 TO 25: PRINT AT 21,
f,s: BEEP .05,f: PRINT AT 21,f-1
," ": NEXT f
390 FOR f=21 TO 18 STEP -3: PRI
NT AT f,25,s: BEEP .05,f: PRINT
AT f,25," ": NEXT f
400 FOR f=25 TO 14 STEP -1: PRI
NT AT 18,f+3," ",AT 18,f,s: BEEP
.05,f: NEXT f
410 PRINT AT 18,14,s,"   "
412 FLASH 0: PAPER 0: INK 7
420 LET hs=s: GO TO 270
1000 DATA 24,24,126,24,24,36,36
36
1010 DATA 153,90,60,255,255,60,9
0,153
```

Red Carpet
by Gavin Devine

Screen Colour

on Vic20

This program enables the use of the function keys to change the screen/border colour combinations

F1 Decrements the contents of (36879)
F3 Increments the contents of (36879).
F5 This resets the screen/border colour to white/blue

The program works in the following way

The keyboard is scanned every 1/60th second by the interrupt routine location 197 on the zero page will contain different values depending on the last key pressed The relation between the contents of this address and the key pressed are as follows

Function 1 = 39
Function 3 = 47
Function 5 = 55

Control branches to three saperate subroutines consecutively At each routine the contents of 197 are checked against the values for the appropriate function key It they tally the contents of (36879) are either incremented/decremented or loaded with 27 which resets the border/screen colour to normal

Control then branches to (60095), and the process is repeated

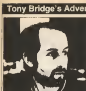
To start the routine SYS 673

To stop run/stop restore

```
5 REM************************
7 REM**F1 DEC REGISTER ******
11 REM**F3 INC REGISTER *****
13 REM**F5 CHANGE NORM. *****
17 REM**SYS 673 START   *****
19 REM**RESTORE END    ******
21 REM***********************
30 I=673
40 READ A:IF A=999 THEN END
50 POKE I,A:I = I+1:GOTO 40
100 DATA 169,173,141,20,3,169,2,
    141,21,3,96
110 DATA 234,32,187,2,32,208,2,32,
    227,2,76
120 DATA 191,234,234,234,165,197,
    201,39,240,1,96
130 DATA 173,15,144,201,0,208,1,96,
    206,15,144
140 DATA 96,234,234,165,197,201,47,
    240,1,96,173
150 DATA 15,144,201,255,208,1,96,
    236,15,144,96
160 DATA 165,197,201,55,240,1,96,
    169,27,141,15
170 DATA 144,96
180 DATA 999
```

```
LDAIM 173
STA 788
LDAIM 2
STA 789
RTS
NOP
JSR FN1
JSR FN3
JSR FN5
JMP 60095
NOP
NOP
*FN1 LDAZ 197
CMPIM 39
BEQ 1
RTS
LDA 36879
CMPIM 0
BNE 1
RTS
DEC 36879
RTS
NOP
NOP
*FN3 LDAZ 197
CMPIM 47
BEQ 1
RTS
LDA 36879
CMPIM 255
BNE 1
RTS
INC 36879
RTS
*FN5 LDAZ 197
CMPIM 55
BEQ 1
RTS
LDAIM 27
STA 36879
RTS
```

Screen Colour
by Robert Watson



Atari adventures!

Now that Atari has cut the price of its machines to compete with the other popular micros, they are coming into the budget of many more computer enthusiasts. The range of software available is second to none most of the worthwhile packages coming from the United States.

There have been several good text adventures written for the Atari though the number available is certainly nowhere near that for the TRS80 or Spectrum. The Atari relies on large commercial software house far more than the Sinclair or Commodore range of computers — and the large houses are usually interested in arcade games rather than mind games.

To begin our look at representative software, let's load in *Pharoah's Curse* from Synapse Software. This name will be well known to present Atari users as an American producer of consistently high quality software.

Pharoah's Curse is written by Steve Colman and is a straight down-the-line arcade adventure. You have to guide your little explorer down the funnel of the pyramid, in a search for the pharoah's treasure. Each of the four levels consists of 16 rooms — once you have collected all the treasure on one level (there is one item in each room) and survived, you are given a password to get you to the next.

The hazards range from little buttons which, when stepped on, shoot out flames which will roast you to rods which rise and fall from the roof of narrow passages.

The strange colours (gold mauve grey and purple) of the weird-shaped room the myriad puzzles (each room has its unique combination of conundrums to be solved) and the continuous noise make it an ideal game.

Journey to the Planets from another well-respected American company JV Software (which produced *Ghost Encounters* and *Action Quest* that I wrote about some weeks ago) has an arcade flavour but is much closer to the traditional adventure. Starting off on your world, your task is to visit all the planets in the galaxy and find the treasure hidden on each one. Like the traditional adventure there are objects close at hand which will help you in your quest you just have to find them! Each planet consists of six separate screens or sections which can be explored at will.

The arcade action starts as soon as you've exhausted the possibilities on your home planet. Move on to that funny little H-shaped thing and press *Fire* on the joystick. Yup, it's your spaceship! After lift-off you can manouvre your craft with the joystick — the engines fire in all four directions and movement is inertial so a delicate touch is needed in order to stay on the screen. A second touch of the *Fire* button will reveal a galactic map on which your progress is charted, along with planets explored and unexplored.

You can choose which planet to visit next and some more arcade action awaits you here. Apart from the odd meteroid trying to nudge you into oblivion you will have to negotiate the wickedly designed approaches to the planet's surface.

All in all a rather charming program with the typical Atari low high resolution graphics and piping fairground music.

Although several text adventures are available for the Atari it is surprising that no one has come up with a *Hobbit* to utilise the graphic capabilities of the machine, in combination with a good text adventure.

Staying with the Atari, I have only one enquiry about an adventure for the machine. This is from B Walker from Romford (you know, home of the beer). He is playing *The Sorceress* and seems to have completed quite a bit of it, but now he seems to be stuck in getting the cannon from the ship neither can he blow a hole in the wall. Can any Atarists help us?

Meanwhile don't forget — *Jabba the Hutt merely has a slight weight problem!*

```
1000 LET O$=""  INPUT "CODED
     MESSAGE",C$
1010 LET CN=LEN C$-7*INT (LEN
     C$/7)
1020 IF CN<3 THEN LET CN=CN+3
1030 IF CN=LEN C$ THEN LET
     CN=CN-1
1040 FOR M=1 TO LEN C$
1050 LET X=0
1060 FOR I=1 TO CN
1070 FOR J=I TO LEN C$ STEP CN
1080 LET X=X+1
1090 IF J=M THEN LET O$=O$+C
     $(X)
1100 NEXT J
1110 NEXT I
1120 NEXT M
1130 PRINT O$
```

This series of articles is designed for novice and experienced Adventurers alike. Each week Tony Bridge will be looking at different Adventures and advising you on some of the problems and pitfalls you can expect to encounter. So if you have an Adventure you want reviewed or if you are stuck in an Adventure and cannot progress any further, write to Tony Bridge Adventure Corner, *Popular Computing Weekly* Hobhouse Court 19 Whitcomb Street London WC2 7HF.

Cruising & Blind Alley

£10 to be won

Can you beat the new high score?

Cruising

First there was *Space Invaders* then there was *Pacman* – now there is *Cruising*. This all action machine code arcade type game will test your powers of co-ordination to the limit. Never before has a game asked you to think so quickly or move so fast.

Achieving a high score on *Cruising* takes considerable skill and not a little patience.

Popular Computing Weekly is offering £10 each month to the player with the highest score on *Cruising*. All you have to do to enter this month's competition is send a print-out of your highest score together with your name and address to

Popular Computing Weekly
Cruising
Hobhouse Court
19 Whitcomb Street
London WC2 7HF

Each month we will publish the name of the winner and the new *Cruising* high score. Are you good enough to accept the *Cruising* challenge?

The winner of last month's competition with a score of 22864 was I C Willis of Shore Lane Sheffield who receives £10. Entries for this month's competition close on June 30.

Notes

1) Each entry must consist of a ZX printout and your name and address.
2) Closing date for this month's *Cruising* challenge entries is June 30.
3) The highest score each month will receive £10.
4) High scores cannot be transferred from one month to another.
5) The judges decision is final.
6) No employees of Sunshine Publications Ltd or their families will be eligible to enter.

Blind Alley

Blind Alley is a game of strategy. In order to win you must outwit the computer using your craft to fence in and finally destroy the enemy pursuit vehicles. But watch out for the solid trail left by your opponents — one touch is fatal!

Each month *Popular Computing Weekly* is giving away £10 to the player with the highest score on *Blind Alley*. To enter this month's competition simply send in a copy of your score and the code at the bottom of the score table together with your name and address to

Popular Computing Weekly
Blind Alley
Hobhouse Court
19 Whitcomb Street
London WC2 7HF

The highest score sent in so far this month is 70625 from Stuart Williamson of Bradford West Yorks. Entries for this month's competition close on June 30.



PLOTTING ROUTINE

Paul O'Neil of Main Street Chappenhall Airdrie Strathclyde writes

Q I wish to interface a ZX printer to a MZ80A and I would be grateful if any reader could offer some assistance. What I/O device does the ZX81 printer have, (assuming that it is I/O mapped). Also does anyone know of a routine to plot hi-res graphics on the device (I do appreciate that the graphics might be completely different to the MZ80A graphics)

A The ZX printer is not I/O mapped in the memory map, which means that you will have to access it through the I/O map of the CPU So any programs you write controlling the printer with the MZ80A will have to be written in machine code

There is some useful information on page 4 of the manual that comes with the printer As you can see A2 will have to be low for the printer to work at all and the same section tells you what the data lines D0 to D7 control

I have not got any specific information about hi-res plotting using the MZ80A but you must keep in mind that the printer is a serial device that plots characters line by line, a pixel at a time Thus it could plot (256 × 7) +8 pixels, before it completes the first full character

CONDITIONS OF SALE

C J Knee of Alphington Essex writes

Q I have written a number of original games for my Vic20, and am considering selling them. But, I have run up against one main problem, namely copyright.

I have looked up copyright in the local library, but could find nothing of practical use. I am sure I am not alone, so could you please include something about protecting software through copyright

A We ran a long article on software copyright in our 3 9 February issue Since then there has been quite a lot of correspondence in our Letters page concerning software libraries and the use of compilers but nothing has been resolved

There seems to be no sign of action by the government, so the tradition of legal precedence is probably going to be the final arbitor But, as yet, the precedents have still to the created

The legal questions will partly revolve around the type of software you are developing for example, when is *Space Invaders* not *Alien Invaders*? Just what constitutes a copy will probably have to be settled by specific court cases

If you are developing completely new software then I can only suggest that you have a very clear note on your cassette as to who owns the copyright If you want to avoid libraries using your cassette without paying a royalty add a note to the effect that the cassette may not be hired or lent without prior permission, and that this is a condition of sale

You might find it useful to contact the recently formed CTA (Computer Trade Association) It has already established a committee to look into this problem

HI-RES DUMP!

D Owen of Brander Road Leeds writes

Q I use two BBC computer model Bs, one has the 0.1 operating system, and the other has the 1.2 I would like to know how to dump hi-res graphics from the screen on to an Epson Mk III printer I am writing a program where the user would make his own graphics, and then dump them straight on to the printer If you could help me I would be grateful.

A I'm afraid that I have not got a program to dump hi-res graphics from the screen on to an Epson printer, and as I have not seen a copy of your program I do not really have any idea of how to help you specifically The only thing that I can suggest is that you have a look at *Laserbug* issue 11, April 1983 It contains an in-depth review of the Epson in use with the BBC, and though it does not give the hi-res dump program you want, it might supply you with sufficient extra information to develop your own

VOLUME AND TONE

B Walton of Brentwood Close Holywell Whitley Bay Tyne & Wear writes

Q I bought a 48K Spectrum Upgrade kit from Watford Electronics which come back with four chips (741s) soldered in place. The instructions for available memory is *Print Peek* 23732 + 256 **Peek* 23733; this should give 65536, however it only gives 65535 When the upgrade is not fitted it should give 32768, but it only gives 32767 Is this correct?

Upon *Saving* a program all appears well until it's used, when nothing happens. This also happens with *Load*. It sounds all right on the tape and I have tried all the usual things such as wriggling the leads and so on I can *Load* existing tapes, but it will not *Save* and re*Load* This problem happens whether or not the extra memory is fitted

A Your first question crops up a lot on a wide variety of computers Many people forget that a computer starts counting at nought thus 0 is the first address, which makes 1 the second address, and so on

Problems with Spectrum *Save* are beginning to filter through I do not think that it will approach the epidemic proportions that *Loading* did on the ZX81, but nevertheless, it should not happen In all fairness I do not think that the Spectrum is solely to blame Commercial cassettes are recorded at such a wide range of levels that sometimes quite major changes of volume and tone are needed, despite the Spectrum being very tolerant to a wide range of levels

The thing to look out for are the bars that move up the screen, around the box If there are no bars, then the volume is too low to raise a signal In the same way, if they start to flicker or jitter too wildly then the volume might well be too high You say that you have listened to the tape and it sounds all right If, in fact, it is not very loud when you have the volume turned right up then it might well not be all right The only other thing that I can suggest is that you pull out the other lead in case it is causing interference If you still get problems then it would probably be best to return your computer

SPECTRUM POTENTIAL

Eugenio Da Costa of Rua Ferreira Borges, 1300 Lisbon Portugal, writes

Q I am very interested in buying a ZX Spectrum, out I am concerned about its potential for driving a disk unit, other than Sinclair's own

More specifically, would it be possible for the Spectrum to drive another manufacturer's disk unit via a RS232C interface, in conjunction with another manufacturer's operating system? If it is any help I would want to use it with an Apple disk drive

A Now that an RS232 interface is available for the Spectrum, it can be made to access quite a wide range of disk drives, printers and other peripherals I can see no problem specifically with the Apple disk drive or any other, as long as it has the RS232 interface

As for the operating system, you will have to write your own to enable the computer to address the disk drive whatever make it is

Is there anything about your computer you don't understand, and which everyone else seems to take for granted? Whatever your problem *Peek* it to Ian Beardsmore and every week he will *Poke* back as many answers as he can. The address is *Peek & Poke, PCW*, Hobhouse Court, 19 Whitcomb Street, London WC2 7HF

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Dragons for sale

DRAGON 32 as new + software £165 ono Tel 01-805 1042

DRAGON 32 three months old £160 ono or swap for Spectrum 48K Tel 01-794 0148 evenings

SWAP DRAGON SOFTWARE or other Dragon software Tel Jeff 061 6825225

SWAP DRAGON 32 tapes for other Arcade or Adventure tapes Tel Monk, Exeter 59126 after 6 pm

DRAGON 32 + joysticks cassette games Centronics printer card Polaris Project Nebular Meteroid cartridges graphics books cost £300 sell £220 ono Also Line Printer Seven (Tandy) Hi-res graphics 80 columns cost £250 accept £180 ono Both above £380 Tel 0632 581811 (after 5 pm)

DRAGON 32, many cassettes to swap Tel Stuart New Milton 0425 611604

CAVE HUNTER CARTRIDGE as new cost £20 sell £12 Tel 025-126 3331

DRAGON 32 + cassette recorder books joysticks over £100 of software £200 ono Tel 0484 38502 (any time)

DRAGON all leads manuals, £90 software £180 Tel Welwyn 4390

DRAGON 32 with joysticks £180 software still under guarantee £250 ono Tel Weybridge 41868

DRAGON 32, only 6 months old + cassette software and books £160 Tel Great Yarmouth 55805

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ATARI VCS as new with four cartridges including Demon Attack and Missile Command complete with joystick and paddle controllers plus bulletins £85 Tel 01-582 5791 evenings

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ATARI VCS + PacMan and Video Chess tablets as new mint condition £75 Tel 348 5668 after 5 pm

ATARI VCS + 6 cartridges Including Defender PacMan Invaders Asteroids £85 Tel 01-555 6317

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ATARI 800 SOFTWARE to swap or sell games Tel 444834 (High Wycombe)

ATARI 400 or 800 Space Invaders cassette £10 ono Tel 01 590 6014

ATARI VCS, Combat Airsea Space Invaders Adventure £65 Tel King's Langley 64607 after 4 pm

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ATARI 400 boxed 2 months old, with cassette recorder paint, master joystick software cost £255 accept £145 Tel Bolton 0204 40319 after 6 pm

ATARI 800 with basic with program recorder joystick, £200 software £375 ono Tel 01-958 5508 after 6 pm and weekends Can deliver

ATARI 400 16K, still under guarantee £750 of software £299 Tel Rainham (Essex) (76) 22077 after 6 pm

ATARI VCS + five cartridges including Defender and Space Invader £75 ono Tel Bradford 02748 7847

ATARI 800 + disk drive cassette recorder joystick plenty software cartridges disks Star Raiders Shamus etc, £575 ono or sell separately Tel: 01-571 2870

ATARI VCS + Asteroids and Combat cartridge £70 Tel Basildon (0268) 281458

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VIC20 + C2N all under guarantee + dust cover + Vic Computing magazines + books + cassettes £150 Tel 001 327 4988

VIC20 + C2N + 8K + 3 Rom cartridges + other cassette software + magazines cost £300 will sell for £260 Tel 0644 237678

VIC CASSETTE DECK + games for £80 Tel 01-455 2651 (5 pm)

VIC SUPER EXPANDER, £20 ono Adrian tel Chesterfield (0246) 851379

VIC20 + C2N cassette deck, super expander joystick unit various games books and magazines 3 months old still boxed £150 Tel 0563 34855
VIC20 + C2N cassette deck 16K memory expansion joystick books £120 of software £250 Tel 0603 875298
VIC20 super expander Tel 808 6450
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VIC20 + cassette unit + joystick four months old £140 + offers for software and books Tel Billericay 68412 after 6 pm
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VIC20 + cassette still under guarantee £250 worth of software £180 Tel Stoke-on-Trent 332848
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CHESS COMPUTER and split levels cost £90 10 months old £45 ono Tel 021-476 8382 after 6 pm
SWAP £40 SPECTRUM SOFTWARE, 16K + 48K Including Time Gate Penetrator + 3D Tunnel for a Sinclair Printer and paper Tel 01-254 0426
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SWAP ZX81 16K Arcade + adventure games, details Tel 0602 289069 between 4 and 5 pm
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NASCOM II, 8K NAS-CYS III graphics Rom, Basic PS manual £125 Tel 01-363 5075
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SPECTRUM SOFTWARE Cyberats Schizoids Pastimes Arcadia all in mint condition £3 50 each or £13 for all Tel St Helens 26314
SWAP PHILIPS G7000 with £170 of cartridges for anything to do with Dragon 32 or swap for Intellivision or any colour computer Tel 01 730 4269
SOFTWARE for BBC Model A or B Asteroids Invaders Fun games and seven language programming for BBC computer worth £32, sell for £20 Tel Wigan 58719
ASCOM 1 nas sys 1 Basic 48K Ram PIO Coltee Standard cassette interface IMNC Manpower mags £270 ono Tel Stevenage 55356
SWAP Spectrum games for others Games include Horace/Spiders and Colour Flash Tel 0622 61617 after 6 pm ask for Ian

Wanted

WANTED computer and video games magazines Nos 5 and 3 Will pay up to £1 50 each Tel 0341 280726
WANTED BBC Model A In exchange for 48K Lynx + £25 cash (brand new and still n side) Tel 0798 22207
WANTED BBC micro or Commodore Vic20 Tel 01 359 3120
VIC20 owner in Nottingham area to exchange software and ideas Tel 397892
WANTED ZX Spectrum 16K under £90 Tel 0603 47137
WANTED BBC Model B Tel (office) 207 5840 (home) 207 2615
WANTED TANDY colour computer owners interested in swapping software Tel Palsall (0922) 891616
WANTED FELLOW SPECTRUM owners in Newcastle area for exchange of software and ideas Tel Newcastle 658752
WANTED BBC MICRO — preferably in good condition — will pay up to £300 Tel Stonehenge 43343 after 5 pm
8K RAM CARTRIDGE. Commodore in exchange for super-expander cartridge + some money 0442 58200
WANTED ZX PRINTER Tel Bournemouth (0202) 429429
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WANTED SPECTRUM 48K Details please to K Slader Woodside Cottage Woodlands Southampton SO4 2GN
WANTED BASIC COMPUTER for Vic20 Tel 051-982 3633
WANTED ZX SPECTRUM, 16K or 48K cash waiting 0643 371090
EXPANSION INTERFACE + disc drives + printer suitable for TR80 LVII Tel Carlton on Tofton 898547 or 861618

NEW RELEASES

PART TWO



Spectrum Starter Pack 2 is the second release in the Collins series designed to teach you how to program

Each pack in the series consists of a handbook and cassette *Pack 2* continues where the first part left off and contains a number of routines which stress the sound and colour available on the machine

Programs include *Sound* — which turns your Spectrum into an electronic organ — and *Bar Chart* — which illustrates how bar charts can be constructed from figures

Program *Spectrum Starter Pack 2*
Price *£9 95*
Micro *Spectrum*
Supplier *Collins Educational*
PO Box
Glasgow G4 0NB

CAT & MOUSE

Confuse the Cat is a new game for the 32K model B BBC computer The decidedly odd scenario involves moving a cat around a cellar during a power cut looking for objects which will enable him to eliminate each mouse

The game is intended in the first instance to be a sort of adventure where you must gradually discover the uses for each of the various objects

However the manufacturer claims that you can play the game more than once because tactical skill comes into play — how quickly can you eliminate the mice?

The cat s salary is £5 000 with a bonus for each mouse caught However, a poor performance could mean demotion

Program *Confuse the Cat*
Price *£4 50*
Micro *BBC B*
Supplier *EF Computing*
6 Victoria Road
Stockbridge
Sheffield
S30 5FW

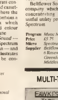
COMPOSER!

Music Maker is a program for the 48K Spectrum designed to enable you to write your own music It uses a mixture of Basic and machine code to enable you to choose time signature, key note value and note pitch Once your creation is finished, you can play it back and *Save* it on tape

Bellflower Software is a new company which seems to be concentrating on providing useful utility programs for the Spectrum

Program *Music Maker*
Price *£5 75*
Micro *Spectrum 48K*
Supplier *Bellflower Software*
6 Rosewood Avenue
Greenford
Middlesex

MULTI-TAPE



Fawksoft is a software company still catering for the ZX81 *Tape 1* contains four games *Dodge It*, *Trojan Dragon* *Death Trap* and *Tablets of Hippocrates*

The games are a mixture of machine code and Basic and are both arcade type — *Dodge It* — and Adventure — *Tablets of Hippocrates* All of the games require 16K of memory.

Program *Tape 1*
Price *£4 95*
Micro *ZX81 (16K)*
Supplier *Fawkes Computing*
41 Wolfridge Ride
Alveston
Nr Bristol BS12 2RA

TRACE IT!

Trace is a machine code utility program designed for use with Basic programs

The program shows you how the computer executes each line of Basic The current line of Basic is highlighted before it is executed

The program is intended to be used in the teaching of computer languages as well as for the home user

Program *Trace*
Price *£6 95*
Micro *Spectrum*
Supplier *Texgate*
14 Brook Lane
Corfe Mullen
Dorset BH21 3RD

BIZARRE!

Softek is familiar to Spectrum owners because of its compiler — now reduced in price to £9 95 However it has just issued five arcade style games

Of the five, *Joust* is the most unfamiliar and bizarre Using the keyboard you control a giant bird — an ostrich which you pilot (well what is the term when you sit on a bird?) in a joust against enemies who are also sitting on birds

Softek is stressing the high-resolution ' flap' of the birds which it says compares favourably with the achievements of both Psion and Imagine

Program *Joust*
Price *£5 95*
Micro *Spectrum*
Supplier *Softek*
329 Croxted Road
London SE24 9DB

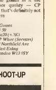
NO STIGMA

CP White (Services) has another new release for the Vic *3 Games* is exactly that — three games entitled *Gas Light* *Pea Picker* and *Apple Cropper*

The company says that each of its games could be sold separately — there is a stigma attached to the "games pack" because the games in it are usually poor quality — CP White says that's definitely not the case here

Program *3 Games*
Price *£3 50*
Micro *Vic20 (+3K)*
Supplier *CP White (Services)*
52 Northfield Ave
West Ealing
London W13 9SY

SHOOT-UP



Oric software is finally arriving in dribs and drabs IJK Software is a company that has previously specialised in BBC programs but it has now issued three cassettes for the 48K machine

Xenon 1 is in classic "shoot em up" mould with several waves of aliens You must beat off the Aards and travel on through meteorite showers until you can refuel and defend your planet from the Paratrons

The ' ultimate accolade ' is to destroy the Zorgon battle star which will appear at the end of the game if you survive

It all sounds like the classic format — if Oric owners are the same as owners of all the other micros, it should do well

Program *Xenon 1*
Price *£8 50*
Micro *Oric 48K*
Supplier *IJK Software*
9 King Street
Blackpool
Lancashire

NEW RELEASES

BY TOUCH



In the world of Dragon software Microdeal is one of the market leaders, in terms of number of products at least

Its latest release is *Backgammon* — a computer version of the popular board game There are nine skill levels and the computer can even be made to play against itself

A novel feature is that the Microdeal light pen will work with this game, allowing you to enter your moves merely by touching the screen

Program *Backgammon*
Price *£8 00*
Micro *Dragon 32*
Supplier *Microdeal*
14 Truro Road
St Austell
Cornwall PL25 5JE

ADVANCED

The Spectrum book market is so vast that even the fairly advanced area of machine code has at least three books to itself — and still they keep on coming

Spectrum Machine Code is the latest addition to Shiva's friendly micro series Authors Ian Stewart and Robin Jones are well-known for their previous books (*Machine Code and Better Basic* was serialised in *PCW*)

Book *Spectrum Machine Code*
Price *£5 25*
Micro *Spectrum*
Supplier *Shiva Publishing*
4 Church Lane
Nantwich
Cheshire CW5 5RQ

TWISTED!

Pentagon is a company offering independent Dragon software It has just released *Dragon Hawk*

This machine code game involves fighting off enormous birds that swoop towards you — so far so Galaxian — but the twist is that this is just a screen to enable the mother bird to fly down and pick up a little man

Your main aim is to defend the man and shoot down the bird if it should pick him up If that isn't enough there are some tiny flys for you to attack

Program *Dragon Hawk*
Price *£6 95*
Micro *Dragon 32*
Supplier *Pentagon*
31 Banks Ave
Ackworth
Yorks



3-D MAZE



Brother Software is a new name in Dragon games The Hertfordshire based company has just issued its first release, *Maze Men*

The game involves shooting all the men in a maze But, because the maze is three-dimensional and certain parts of it look very similar, this is made very difficult

Another three games will soon be available from the company

Program *Maze Men*
Price *£5 00*
Micro *Dragon 32*
Supplier *Brother Software*
25 Augustus Close
St Albans
Herts

SPRITELY!

Atari owners will be fairly familiar with the English Software Company but now it is catering for the Commodore 64 as well

Sprite Maker 64 is a utility program that gives access to the sprite capability of the machine

You use a cursor to design the sprite capability of the which can then be saved and used in your own program

Program *Sprite Maker 64*
Price *£6 95*
Micro *Commodore 64*
Supplier *English Software Company*
50 Newton Street
Piccadilly
Manchester
M1 2EA

ADDICTIVE!



Simon Wadsworth

Arctic will soon issue *Adventure E — The Golden Apple*

Its previous adventure games — A to D — have built up a strong reputation for being addictive and fiendishly difficult to solve — so much so that Arctic has a number of help sheets available

Simon Wadsworth, the author also wrote *Invasion Force* and *Gobbleman* for Artic Simon is managing to combine A level study with the development of his next adventure — F

Program *The Golden Apple*
Price *£6 95*
Micro *Spectrum 48K*
Supplier *Artic Computing*
396 James Reckitt Ave
Hull
N Humberside

New Releases is designed to let people know what software is coming on to the market If you have a new game or utility which you are about to release send a copy and accompanying details to New Releases Popular Computing Weekly 15 Whitcomb Street London WC2 7HF

Ziggurat



Root causes

I have my trusty calculator clock before me I enter *11111111* and then press the square root button the answer is *3333.3333* (and we can guess that the *3s* continue on for ever)

If I square the number (which is supposed to be the square root of *11111111*) by using *X* and then — the result is *11111110*. The square of the square root does not equal the original number Obvious really would you not think?

My wee calculator does not have an infinite capacity and thus is not able to store an unending sequence of *3s* — it has an eight digit accuracy The number I used above (*11111111*) has eight digits and thus is stretching its accuracy to the limit. If I enter *1111* the square root is *33.331666* and the square of the square root is *1110.9999* — accurate to seven significant figures

What I have just found for my calculator does not hold for all calculators — some round off numbers whereas mine just chops the end off

Chopping the end off is called chopped arithmetic on posh computers but we all know that computers are just calculators putting on airs ... or are calculators computers with an inferiority complex ... ?

We do not have to construct an example anywhere near as complex to illustrate the same sort of quirk on a computer

Try this tiny program

```
10 INPUT X
20 S = X/2
30 FOR I = 1 TO 25
40 S = (S + X/S)/2
50 PRINT S
60 NEXT I
70 PRINT S-SQR(X) S-(SQR(X) + X/SQR(X))/2
```

which produces a string of 25 values of *S* where *S* becomes closer and closer (very soon) to the square root of the number we have input as *X*

This is the method for calculating square roots known as Newton's Method and it is an example of an *iterative* method — going through a routine repeatedly each time getting closer to the desired answer

Many estimation methods work on similar principles We estimate a value and then use that estimate to produce a new estimate For those who are interested in such things the general form of Newton's equation is, when $F(x) = 0$

$$x(i) = x(i-1) - F[x(i-1)]/F^1[x(i-1)]$$

In English this means that the *i* th estimate of *x* is given by the value of the $(i-1)$ th estimate less the function of *x* divided by its differential at the value *x*

What is the function in this case? Well

$$F(x) = x^2 - V = 0$$

and the differential of the function is

$$dF/dx = F^1(x) = 2x$$

so that

$$F(x)/F^1(x) = (x^2 - V)/2x$$

and

$$x - F(X)/F^1(x) = x - x/2 + V/2x$$
$$= (x + V/x)/2$$

QED — and if it ain't QED work it out again

(Incidentally Chapter 15 in *Pure Mathematics* by A J Sherlock *et al* (John Murray) is a fair explanation at A-level standard.)

In the program above for some values the *Sqr* function does not agree with the totally accurate value *S*

S is as accurate as the machine can allow The *other* value should never differ unless the *Sqr* function is amazingly inaccurate

If you try

```
X = 0 FOR I = 1 TO 1000 X = X + .001 NEXT I
PRINT X
```

the value of *X* is not $0.001 \times 1000 = 1$ It is usually less — why?

Talking of problems and squares and square roots I noticed an easy one to do with the sides of triangles It is possible to have an integer sided triangle with *any* odd number being the smallest side

Let the little side be *m* and the other sides be *n* and $n + 1$ Then $(n+1)^2 - n^2 = n^2 + 2n + 1 - n^2 = 2n + 1$

As $m^2 = (n+1)^2 - n^2$ then $n = (m^2 - 1)/2$ ■

Boris Allen

Puzzle

Howzat!

Puzzle No 60



When Arthur dreamed he dreamed of cricket — and in particular of the team for which he played — the Stickshire cricket club

He dreamt of a famous victory Not all the side batted, but each player who did made a score equal to one of the divisors of the total Each batsmen scored less than the one before and each divisor of the total appeared once on the score sheet. (One is counted as a divisor but not the total itself — for example the divisors of 12 are 6 4 3 2 and 1.)

These intensely mathematical imaginings bothered Arthur greatly Not because he couldn't stop them from happening Not because he did not know why they came Not even because they also bothered his analyst

What really rankled was that he could never work out the final score All he could remember was that the opening batsmen made a double century and a century

Can you work out how many batted and what their scores were?

Solution to Puzzle No 55

The problem was to find a succession of right angle triangles each with sides an exact number of units such that the longest side of each triangle forms the shortest side of the next

The first two are 3 4 5 and 5 12 13 The program to find the next three triangles in the series is

```
10 A = 3 20 FOR N = 1 TO 5 30 X = A Y = A + 1
40 Z = SQR(X*X + Y*Y) 50 A = INT(Z) 60 IF Z -
A<1E-5 THEN 80 70 Y = Y + 2 80 GOTO 40 90
PRINT X Y A 100 NEXT N
```

The difficulty with the problem is the inaccuracy of the *Sqr* function on most micros Line 60 takes this into account when it checks that *Z=A* to within a thousandth of a percent

The answers given by the program are for the next three triangles in the series 13 84 85 85 132 157 and 157 12324 12325

Winner of Puzzle No 55

The winner is A F Salisbury Clifton Drive South St Annes-on-Sea Lancs who receives £10

Top 10

Vic20

1	(1)	Introduction to Basic Part 1	(Commodore)
2	(5)	Panic	(Bug-Byte)
3	(4)	Wacky Waiters	(Imagine)
4	(6)	Asteroids	(Bug-Byte)
5	(—)	Arcadia	(Imagine)
6	(8)	Amok	(Audiogenic)
7	(7)	Cosmiad	(Bug-Byte)
8	(3)	Blitz	(Commodore)
9	(—)	Sea Wolf	(Audiogenic)
10	(—)	Chess	(Bug-Byte)

(Figures compiled by Boots & Co London)

Spectrum

1	(1)	Flight Simulation	(Psion)
2	(3)	Penetrator	(Melbourne House)
3	(—)	Jetpac	(Ultimate)
4	(5)	Transylvanian Tower	(Richard Shepherd)*
5	(5)	3D Tanx	(DK'Tronics)
6	(2)	The Hobbit	(Melbourne House)
7	(4)	Horace Goes Skiing	(Psion/Melbourne House)
8	(—)	Ah Diddums	(Imagine)
9	(7)	Arcadia	(Imagine)
10	(6)	Chess	(Psion)*

*Requires 48K

(Figures compiled by W H Smith and Son Ltd)

Atari

1	(1)	Zaxxon	(Datasoft)
2	(2)	Miner 2049er	(Big Five)*
3	(—)	Hellcat Ace	(Microprose)†‡
4	(—)	Stone of Sisyphus	(Adventure International)‡
5	(—)	Chop Lifter	(Broderbund)*
6	(7)	Pharaoh's Curse	(Synapse)†
7	(—)	Salt Dragon	(Adventure International)
8	(—)	Astro Chase	(First Star)†‡
9	(6)	Shamus	(Synapse)
10	(—)	Defender	(Atari)

*Cartridge †32K cassette ‡32K disc §48K disc

(Figures compiled by Calisto Computers, Birmingham 021-632 6458)

Dragon

1	(1)	The King	(Microdeal)
2	(2)	Space War	(Microdeal)
3	(5)	Katerpiller Attack	(Microdeal)
4	(—)	Planet Invader	(Microdeal)
5	(10)	Dragon Trek	(Salamander)
6	(4)	Alcatraz	(Microdeal)
7	(3)	Defense	(Microdeal)
8	(7)	Mansion Adventure	(Microdeal)
9	(—)	Madness and the Minotaur	(Dragon Data)
10	(8)	Chess	(Dragon Data)*

*Cartridge

(Figures compiled by Boots & Co London)

BBC*

1	(1)	Rocket Raid	(Acornsoft)
2	(2)	Planet Planetoids	(Acornsoft)
3	(—)	Sphinx Adventure	(Acornsoft)
4	(—)	Killer Gorilla	(Program Power)
5	(—)	Word Wise	(Computer Concepts)
6	(—)	Desk Diary	(Acornsoft)
7	(—)	Philosopher's Quest	(Acornsoft)
8	(10)	Chess	(Program Power)
9	(2)	Great Britain Limited	(Simon W Hessel)
10	(—)	View	(Acornsoft)†

*All BBC Model B only †Rom chip

(Figures compiled by Micro Management, Ipswich 0473 59181)

ZX81*

1	(1)	Flight Simulation	(Psion)
2	(3)	3D Monster Maze	(New Generation)
3	(4)	Chess	(Psion)
4	(2)	QS Scramble	(Quicksilva)
5	(6)	Catacombs	(J K Greye)
6	(7)	Galaxians	(Artic)
7	(5)	Space Raiders	(Psion)
8	(—)	Alien Dropout	(Silversoft)
9	(—)	Avenger	(Abacus)
10	(8)	10 Games for 1K	(J K Greye)†

*All 16K except where shown. †Runs in 1K

(Figures compiled by W H Smith and Son Ltd)

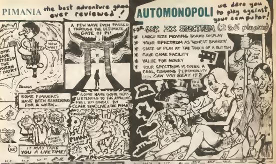
Books

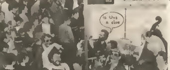
1	(2)	Vic Programmer's Reference Guide, *Commodore*	(Commodore)
2	(1)	Spectrum Rom Disassembly, *Logan*	(Melbourne House)
3	(8)	Spectrum Hardware Manual, *Dickens*	(Melbourne House)
4	(5)	Commodore 64 Programmer's Reference Guide, *Commodore*	(Commodore)
5	(—)	BBC Machine Code for Beginners, *Stephenson*	(Newnes)
6	(6)	6809 Assembly Language Programming, *Leventhal*	(Osborne)
7	(—)	Dynamic Games for your Dragon 32, *Hartnell*	(Interface)
8	(—)	The Working Commodore 64, *Lawrence*	(Sunshine)
9	(3)	Enter the Dragon, *Curtis*	(Melbourne House)
10	(—)	Mastering the Vic20, *Jones*	(Sigma)

(Figures compiled by Watford Technical Books, Watford 0923 23324)

(Last week's position in brackets)

40 Rock ©





SPOT THE DIFFERENCE COMPETITION

HERE IS A PICTURE OF THE AUTOMATA STAND AT A RECENT COMPUTER FAIR. THE OBSERVANT AMONG YOU MAY SPOT SEVERAL DIFFERENCES BETWEEN US & THE OTHER SOFTWARE HOUSES. PLACE THESE DIFFERENCES IN ORDER OF IMPORTANCE BY WRITING THE NUMBERS 1 to 8 IN THE BOXES. FOR EXAMPLE IF YOU THINK DIFFERENCE D IS THE MOST IMPORTANT YOU WRITE THE NUMBER 1 IN ITS ADJACENT BOX. OK?

DIFFERENCE	ONE FREE ENTRY WITH EVERY ORDER	IMPORTANCE
A	Giving back to our public as much as we can ... free jazz band on our stand. Now a saxophone is ...	
B	Automata is committed to non violent games. No killing, no conquering, no bombing ... just First Class entertainment	
C	These back page advertisements are rather silly ... and may well get sillier. Don't we care about making pots of money?	
D	There are eleven thousand red durang animals in the ... large costumes just outside of camera range. Honest there are	
E	There are no computers on our exhibition stand. Our games reputations and their reviews seem to be all that ...	
F	We rather enjoy dressing up in bright pink combinations and Dr Who Dark outfits and then go exposing ourselves	
G	There are a great many happy people with smiling faces in the photograph. This makes us happy too	
H	We are pleased to meet our public face to face. We don't want to lose contact with our most important clients: you	

HAVE YOU FILLED IN ALL THE NUMBERS? GOOD. NOW WRITE A SLOGAN FOR AUTOMATA THAT IS EVEN DAFTER THAN 'WE PUT SOMETING IN COMPUTING' IN NOT MORE THAN TEN WORDS and write it in the following space

Nobody has won the £6 000 Golden Sundial of Pi yet, and we can't wait to give something away, so £100 TO THE WINNER of our SPOT THE DIFFERENCE COMPETITION. All entries must be accompanied by your order (we're not THAT daft) to be received by Tuesday July 5th. The winner's name will be published on this page, Thursday July 14. The judge's decision will be final. So make US laugh for a change

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AUTOMONOPOLI	(Spectrum 48K)	£6 oop	
PIMANIA	(Spectrum 48K)	£10 oop	
PIMANIA	(Dragon32)	£10 oop	
PIMANIA	(BBC Micro 32K)	£10 oop	
PIMANIA	(ZX81 16K)	£5 oop	

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